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# TRANSCRIPT OF RECORD

(IN THREE VOLUMES)

## SUPREME COURT OF THE UNITED STATES

OCTOBER TERM, 1939 1940

No. 674 12

THE UNITED STATES OF AMERICA, PETITIONER

vs.

APPALACHIAN ELECTRIC POWER COMPANY

ON WRIT OF CERTIORARI TO THE UNITED STATES CIRCUIT COURT OF APPEALS FOR THE FOURTH CIRCUIT

VOLUME 3

PETITION FOR CERTIORARI FILED JANUARY 26, 1940
CERTIORARI GRANTED MARCH 4, 1940

# SUPREME COURT OF THE UNITED STATES

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ON WRIT OF CERTIORARI TO THE UNITED STATES CIRCUIT COURT OF APPEALS FOR THE FOURTH CIRCUIT

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| Cross | 1000 | 805 |
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| Direct | 1051 | 847 |
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| Redirect | 1127 | 900 |
| Recross | 1130 | 902 |
| H. G. Gerdes— | | |
| Direct | 1131 | 903 |
| Cross | 1162 | 926 |
| Redirect | 1189 | 947 |
| Recross | 1194 | 950 |
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| Cross | 1256 | 1000 |
| Redirect | 1363 | 1004 |
| Recross | 1365 | 1006 |
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| Redirect | 1944 | 1503 |
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| Cross | 1946 | 1505 |
| Redirect | 1951 | 1509 |
| S. L. Buckland— | | |
| Direct | 1952 | 1509 |
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| Redirect | 1960 | 1516 |
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| Redirect | 2126 | 1549 |
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| Direct | 2135 | 1656 |
| Cross | 2143 | 1662 |
| Redirect | 2152 | 1669 |
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| Cross | 2157 | 1672 |
| J. B. Snethlage— | | |
| Direct | 2158 | 1673 |
| Cross | 2159 | 1674 |
| A. A. L. Mathews— | | |
| Direct | 2160 | 1675 |
| Cross | 2174 | 1686 |
| Redirect | 2195 | 1702 |
| Recross | 2197 | 1704 |
| Harold W. Buck— | | |
| Direct | 2198 | 1704 |
| Cross | 2203 | 1709 |
| R. J. Holden— | | |
| Direct | 2216 | 1720 |
| Cross | 2236 | 1737 |
| Redirect | 2254 | 1751 |
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| Cross | 2273 | 1767 |
| T. A. Patton— | | |
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| Cross | 2283 | 1775 |
| Rufus W. Putnam— | | |
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| Cross | 2313 | 1797 |
| S. M. Yarbro— | | |
| Direct | 2355 | 1834 |
| Cross | 2355 | 1834 |
| Harold A. Thomas— | | |
| Direct | 2364 | 1841 |
| Cross | 2422 | 1883 |
| Redirect | 2488 | 1930 |
| Recross | 2504 | 1941 |
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| Cross | 2530 | 1972 |
| Redirect | 2579 | 2011 |
| F. W. Scheidenhelm— | | |
| Direct | 2581 | 2012 |
| Cross | 2664 | 2077 |
| Redirect | 2710 | 2118 |
| Recross | 2714 | 2123 |
| Redirect | 2717 | 2125 |
| Recross | 2721 | 2132 |

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Exhibit No. 123-A—1934, October 24; Copies of correspondence and reports relating to the Kanawha Falls Plant of Elec-Met. Co. as follows: (1) 1934, Oct. 24; Letter from Capt. Clay, C. of E. to McNinch Chairman, F. P. C. enclosing the following: (2)

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1898, Nov. 12; letter from Wilson Aluminum Co. to Secretary of War. (3) Part of handwritten letter to Brig. Gen'l John M. Wilson, Chief of Eng. dated January 26, 1899. (4) War Department memorandum. (5) 1899, Feb. 13; Letter from Major Bixby to Brig. Gen. John M. Wilson, Chief of Eng. (6) War Department memo. (7) 3 endorsements by War Department. (8) Copy of telegram dated Feb. 17, 1899, from Mr. Wilson, Chief of Engineers to Wilson Aluminum Co. (9) Letter dated Feb. 18, 1894, from Wilson Aluminum Co. to Mr. Wilson, Chief of Engineers. (10) Letter from Sec. of War, Feb. 27, 1899, to Wilson Alum. Co. (original exhibit) 3391 2641
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Exhibit No. 140—1930, March—"Discharge hydrograph wave study of New River at Ivanhoe, March 12, 1930, to March 31, 1930" (original exhibit) 3415 2676
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(c) Kanawha River—Lock and Dam No. 4;
(d) Kanawha River—Lock and Dam No. 5;
(e) Kanawha River—Lock and Dam No. 6;
(f) Kanawha River—Lock and Dam No. 7;
(g) Kanawha River—Lock and Dam No. 8;
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| Exhibit No. 183—Views of pools, shoals, rapids, and dams of Kanawha River and New River between London Lock, W. Va., and Hawks Nest, W. Va.—July 22, 1936 (original exhibit) | 3446 | 2715 |

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| Exhibit No. 198—Map entitled "New River, Va. and W. Va., Navigation improvements between Hinton and Wilson Creek, 1877 to 1889" (original exhibit) | 3482 | 2736 |
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| Exhibits Nos. 200–200–B—3 prints, U. S. Eng. Office, Huntington, W. Va., showing navigation features (barge lift, log chute, etc.) for Bluestone reservoir project (original exhibits) | 3486 | 2736 |

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Exhibit No. 203—Photograph album of ferries on New River (original exhibit) 3486 2737
Exhibit No. 204—Illustration showing how Radford project could affect operating results of Bluestone development (original exhibit) 3486 2737
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Exhibit Nos. 208–209—Topographic maps of sections of Washington Mills reservoir showing conditions—April 17 and April 23, 1936—after break-down (original exhibits) 3486 2737
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Exhibit No. 213—Chart showing longitudinal profiles of Byllesby reservoir (original exhibit) 3487 2738
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Exhibit Nos. 215–217, inclusive—Cross section showing original and present profiles of the Buck reservoir (original exhibits) 3488 2738
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Exhibit Nos. 221–221–E, inclusive—Charts of the Ohio River, Pittsburgh, Pa. to mouth showing topography and soundings (original exhibits) 3488 2738
Exhibit No. 223—Federal Power Commission, National Power Survey, Principal Generating Plants and Electric transmission lines, United States, 1935 (original exhibit) 3488 2738
Exhibit No. 225—1 page—"Energy transactions between Appalachian Electric Power Co. and interconnected systems, 1934 3490 2738

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Exhibit No. 226—Chart—"Study showing operation of Radford with stream flow conditions, as of the week ending Sunday, November 2, 1930, based on load curve, shape proportional to system load reported by Appalachian Electric Co., for week ending November 3, 1935" (original exhibit) 3491 2739

Exhibit No. 227—Map—"Appalachian Electric Power Co., wave study, New and Kanawha Rivers, March 1930" (original exhibit) 3493 2739

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Exhibit No. 230-A—Corrected Exhibit No. 230 (original exhibit) 3495 2740

Exhibit No. 231—Letter dated March 1, 1928, Curtis, Mallet-Prevost, Colt, & Mosle to Federal Power Commission, re Project No. 739, A. E. P. Co. (original exhibit) 3495 2740

Exhibit No. 232—Executive Order of the President authorizing the construction of the Bluestone reservoir project on New River (original exhibit) 3495 2740

Exhibit No. 233—Letter from Wm. W. Belknap, Secretary of War, in answer to the resolution of the House, on February 3, 1871, House Document No. 110, concerning James River and Kanawha Canal (original exhibit) 3495 2740

Exhibit No. 234—"The Congressional Globe"—1873, page 204 and page 206, adoption of resolution offered by Senator Windom (original exhibit) 3495 2740

Exhibit No. 235—"Journal of the House of Delegates of the State of West Virginia for the 11th Session, 1872-3" re James River and Kanawha Canal (original exhibit) 3495 2741

Exhibit No. 236—Report of the Committee of the House of Representatives, containing report No. 76 of the 3rd session of the 42nd Congress, re James River & Kanawha Canal (original exhibit) 3496 2741

Exhibit No. 237—"Congressional Record," Special Session of the Senate of the United States, March 4 to 26, 1873, Volume #1, re James River and Kanawha Canal (original exhibit) 3496 2741

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s exhibits—Continued. Original Print
bit No. 238—Report of Major Craighill with port of Engineers Hutton and Harris, "James ver and Kanawha Canal, United States Engineer fice, Baltimore, Md., April 11, 1873" (original hibit) ---- 3496 2741
bit No. 239—Letter from Senator Davis, of the ate of West Virginia, to Sec. of War, W. W. lknap, dated November 12, 1873, re James River d Kanawha Canal [omitted in printing] ---- 3497 2741
bit No. 240—Report of the Board of Engineers March 18, 1874, on the James River and Kana- a Canal [omitted in printing] ---- 3499 2741
bit No. 241—Report 307, Part 1, Senate, 43rd ongress, 1st Session, "Select committee on trans- rtation routes to the seaboard, April 24, 1874" iginal exhibit) ---- 3565 2741
bit No. 242—Photostatic copy of four pages from ongressional Record," year 1874, re James River Kanawha Canal (original exhibit) ---- 3565 2741
bit No. 243—Statutes at large, Volume 18, Part Page 237, etc., re Act passed June 23, 1874, apter 457, for estimates and surveys on trans- rtation routes to the seaboard (original exhibit) ---- 3565 2742
bit No. 244—Report of Major Craighill, Corps of gineers, U. S. A., entitled "Third Subdivision of Central Transportation Route, January 13, 75" (original exhibit) ---- 3565 2742
bit No. 245—Letter (pp. 54–57 printed herein) m the Sec. of War, etc., Senate Document No. 15, h Congress, 2nd Session, containing the reports Major Craighill and Brig. Gen. Humphreys, Nov. 1876 (original exhibit) ---- 3567 2742
bit No. 246—U. S. G. S. Report No. 20, the itetop Area, Virginia-Tennessee (original, ex- it) ---- 3575 2748
bit No. 247—Photostatic copy of hearing before jor H. M. Trippe, re Diversion of New River N. C. Jan. 13, 1925 (original exhibit) ---- 3575 2749
bit No. 248—Copy of letter addressed to the Hon. J. Noell, East Radford, Va., and signed by R. J. den, Professor of Geology, dated March 4, 1936 ginal exhibit) ---- 3575 2749
bit Nos. 249–252, inclusive—"Aerial photos of ain reaches of New River, being Nos. 35, 58, 56, in Government Exhibit No. 273" (original ex- ts) ---- 3575 2749
t No. 254—Letter dated November 14, 1927, to or E. D. Ardery on "New River Development Radford, Geological Examination," signed by J. Scheidenhelm (original exhibit) ---- 3575 2749

Record from D. C. U. S., etc.—Continued.

| Plaintiff's exhibits—Continued. | Original | Print |
|---|---|---|
| Exhibit No. 255—Letter dated November 17, 1927, to Major E. D. Ardery from F. W. Scheidenhelm on "New River Development No. 6 (Radford), Geological Examination" (original exhibit) | 3575 | 2749 |
| Exhibit No. 256—Letter dated October 16, 1931, to Major Fred W. Herman from F. W. Scheidenhelm, pertaining to maintaining pool levels at dams 2, 3, and 4 on Kanawha River (original exhibit) | 3575 | 2749 |
| Exhibit No. 257—Letter dated September 18th, 1934, to Major John F. Conklin on subject of "Hydroelectric project of Appalachian Electric Power Company on New River near Radford, Va.," by F. W. Scheidenhelm (original exhibit) | 3576 | 2749 |
| Exhibit No. 258—Letter of April 2, 1936, to Major John F. Conklin on "Radford Hydro Project of Appalachian Electric Power Company, Capacity Curve of Reservoir," by F. W. Scheidenhelm (original exhibit) | 3576 | 2749 |
| Exhibit No. 259—Letter dated April 12, 1932, to Major Fred W. Herman, on New River Power Wave Study, by F. W. Scheidenhelm (original exhibit) | 3576 | 2750 |
| Exhibit No. 260—Letter dated April 20, 1932, to United States Engineer Department, signed by Daniel W. Mead and F. W. Scheidenhelm, re "New-Kanawha River Power Wave Study" (original exhibit) | 3576 | 2750 |
| Exhibit No. 261—Telegram dated December 10, 1930, addressed to F. E. Bonner, Executive Secretary, Federal Power Commission, sent by F. W. Scheidenhelm (original exhibit) | 3576 | 2750 |
| Exhibit No. 263—Letter signed by John F. Conklin, Lt. Col., Corps of Engineers, District Engineer, addressed to Kanawha Valley Power Company, "Kanawha River pool fluctuations resulting from operation of the Marmet and London hydroplants" | 3576A | 2750 |
| Exhibit Nos. 264-A, B, C—Aerial photographs of New River from Hinton, W. Va. to Narrows, Va. (original exhibits) | 3577 | 2752 |
| Exhibit No. 265—Document on Report on Application for License, Federal Power Project No. 1175, West Virginia, to Chief of Engineers, U. S. Army, Washington, D. C., dated Feb. 24, 1932, at St. Louis, Mo. (changed to defense exhibit No. 525 as it was already in evidence) (original exhibit) | 3577 | 2752 |

Record from D. C. U. S., etc.—Continued.
Plaintiff's exhibits—Continued. Original Print
Exhibit No. 266—Dated March 12, 1932, informal comment upon the report of the United States Division Engineer at St. Louis, Feb. 24, 1932, on application of Kanawha Valley Power project No. 1175, West Virginia, by F. W. Scheidenhelm, consulting engineer for applicant (original exhibit) 3577 2752
Exhibit No. 271—Copy of protest to A. E. P. Co. against application of town of Galax, Va., for grant and loan from Government for construction of municipal hydro and diesel engine power plant and distribution system (original exhibit) 3577 2753
Exhibit No. 272—Letter dated April 9, 1932, from George Otis Smith to Mr. Thompson (original exhibit) 3578 2753
Exhibit No. 273—Book of aerial photographs of New River, W. Va., Va., and N. C. (original exhibit) 3578 2753
Exhibit No. 274—An Act approved May 6, 1887, incorporating the New River Steam Boat Company, and authorizing them to operate a steam boat on New River (original exhibit) 3578 2753
Exhibit No. 275—Act of February 3, 1888, of the General Assembly of Virginia, to authorize the Radford Land and Improvement Company to erect a dam across New River (original exhibit) 3578 2753
Defendant's exhibits:
Exhibit Nos. 500–504—Discharge hydrographs, a wave study of New River (original exhibits) 3579 2753
Exhibit No. 505—Document dated May 9, 1927, New River Development Company—Record for minutes (original exhibit) 3579 2753
Exhibit No. 506—Copy of 7th Annual Report of the Federal Power Commission 1927 (original exhibit) 3579 2753
Exhibit No. 507—Gage recorder chart of Kanawha River at Kanawha Falls, W. Va., for the period July 6 to 13, 1936, incl. (original exhibit) 3579 2753
Exhibit No. 509—House Doc. No. 190, 70th Congress, 1st Session (original exhibit) 3579 2754
Exhibit No. 510—Letter dated Feb. 5, 1927 from Major H. M. Trippe to F. W. Scheidenhelm (original exhibit) 3579 2754
Exhibit No. 511—Letter dated February 4, 1927 from F. W. Scheidenhelm to Major H. M. Trippe (original exhibit) 3579 2754
Exhibit No. 512—House Doc. No. 91, 74th Congress, 1st Session (original exhibit) (same as exhibit 145, a part of which is set forth at fol. 3419 herein) 3579 2754
Exhibit No. 513—Chart—Power Waves on New and Kanawha Rivers (original exhibit) 3579 2754

Record from D. C. U. S., etc.—Continued.

| Defendant's exhibits—Continued: | Original | Print |
|---|---|---|
| Exhibit No. 514—Letter dated October 20, 1931, from F. B. Duis to F. W. Scheidenhelm re pool levels on Kanawha River (original exhibit) | 3580 | 2754 |
| Exhibits Nos. 515–517, inclusive—Photographs of certain sections of New River (original exhibits) | 3580 | 2754 |
| Exhibit No. 518—Dublin, Va., W. Va., U. S. G. S. Quadrangle sheet | 3580A | 2754 |
| Exhibit No. 519—Scarborough's New Census Map of Virginia, West Virginia, Maryland, Delaware, and District of Columbia (original exhibit) | 3580B | 2754 |
| Exhibit No. 520—Map entitled "The Middle Atlantic Group comprising Virginia, West Virginia, Maryland, Delaware, and District of Columbia," published by National Power Survey (original exhibit) | 3580B | 2755 |
| Exhibit No. 521—Map of Virginia, Maryland, Delaware, and District of Columbia, published by National Map Co., Indianapolis, Indiana (original exhibit) | 3580B | 2755 |
| Exhibit No. 522—Randall McNally Map of Virginia (original exhibit) | 3580B | 2755 |
| Exhibit No. 523—Map entitled "Commonwealth of Virginia, State Highway System, State Highway Commission, July 1936" (original exhibit) | 3580B | 2755 |
| Exhibit No. 524—Map of Giles County, Commonwealth of Virginia, Department of Highways, Richmond, Va. (original exhibit) | 3580B | 2755 |
| Exhibit No. 525—Copy of a report on application for license, Federal Power Project No. 1175, W. Va., dated Feb. 24, 1932 (original exhibit) | 3580B | 2755 |
| Exhibit No. 526—Photograph of Shumate Falls (original exhibit) | 3581 | 2755 |
| Exhibit No. 527—Map dated 11/21/1912. Reconnaissance Map of New River from Hinton, W. Va., to Radford, Va., compiled under direction of Major F. W. Alstaetter. (Same as original exhibit 558-G) | 3581 | 2755 |
| Exhibit No. 528—Report of Major Craighill, Corps of Engineers, U. S. A. dated April 17, 1891 | 3583 | 2755 |
| Exhibit No. 529—Letter dated February 4, 1930, addressed to Federal Power Commission, signed Appalachian Electric Power Company, by Curtis, Mallet-Prevost, Colt & Mosle | 3589 | 2760 |
| Exhibit No. 530—Memorandum, re Federal Commission's authority to adopt a policy of issuing a minor part license for projects located on non-navigable streams and not involving the use of any land or other property of the United States, dated February 4, 1930 | 3589C | 2762 |

Record from D. C. U. S., etc.—Continued.
Defendant's exhibits—Continued. Original Print
Exhibit No. 531—Photostatic copy of letter dated July 21, 1930, addressed to Attorney General of United States and signed Patrick J. Hurley, Secretary of War ..... 3589LL 2779
Exhibit No. 532—Document dated September 22, 1930, addressed to the President and signed by Wm. D. Mitchell, Attorney General. "The following opinion of the Attorney General was released by the Federal Power Commission, Sept. 26, 1930." ..... 3589PP 2781
Exhibit No. 533—Letter of October 6, 1930, to Federal Power Commission signed Appalachian Electric Power Company, by Curtis, Mallet-Prevost, Colt & Mosle ..... 3589YY 2787
Exhibit No. 534—Photostat copy of letter of October 16, 1930, to Federal Power Commission, signed—A. E. P. Co. by Curtis, Mallet-Prevost, Colt & Mosle (original exhibit) ..... 3589ZZ 2788
Exhibit No. 535—Letter dated November 7, 1930, from War Department, Office of Chief of Engineers, to F. P. C. Exec. Secy. signed for Chief of Engineers by Major J. J. Kingman ..... 3589AAA 2788
Exhibit No. 536—Letter dated October 31, 1930, from F. E. Bonner to A. E. P. Co. re Project No. 739 (original exhibit) ..... 3589BBB 2789
Exhibit No. 537—Letter from F. P. C. to A. E. P. Co., dated November 6, 1930, signed by F. E. Bonner, Executive Secretary, and revised draft of minor-part license ..... 3589CCC 2789
Exhibit No. 538—Photostatic copy of letter of November 8, 1930, to General Brown, Chief of Engineers, and signed by F. E. Bonner, Executive Secretary .. 3590 2790
Exhibit No. 539-A—Letter by Federal Power Commission of December 15, 1930, signed by F. E. Bonner, Executive Secretary to Curtis, Mallet-Prevost, Colt & Mosle (original exhibit) ..... 3590A 2795
Exhibit No. 539-B—"Inclosure 7992, from Federal Power Commission, U. S. Government Printing Office 1927." Marked copy. War Department office of Chief of Engineers, Washington, 11/14/1930, addressed to Federal Power Commission, signed "Lytle Brown, Major General, Chief of Engineers" . 3592 2795
Exhibit No. 540-A—Letter dated 11/28/1930 from F. E. Bonner, Exec. Secy. of F. P. C. to A. E. P. Co. (original exhibit) ..... 3593 2796
Exhibit No. 540-B—Certified copy of action of the Federal Power Commission upon application of the defendant for Minor Part license (original exhibit) . 3593 2796

Record from D. C. U. S., etc.—Continued.
Defendant's exhibits—Continued. Original Print

Exhibit No. 541—Memorandum dated October 28, 1930 for the Exec. Secy., signed M. C. Tyler, Lt. Col. Corps of Engineers, Chief of Engineers ..... 3593A 2796
Exhibit No. 542—Copy of letter dated 11/8/1930 to F. E. Ponner from F. W. Scheidenhelm ..... 3593L 2806
Exhibit No. 543—"Maneuvers of dams on Kanawha River during wave test, 1930" (original exhibit) .. 3593M 2806
Exhibit No. 544—"Report of Power Waves, New and Kanawha Rivers" (original exhibit) ..... 3593M 2807
Exhibit No. 545—Location map ..... 3593N 2806A
Exhibit No. 546—Certificate for W. R. Hundly, East Radford, Va. (omitted) ..... 35930 2807
Exhibit No. 547—Four pages; namely, page 848 of the Congressional Record for January 10, 1901; page 1001 of the Congressional Record for January 14, 1901; page 1002 of the Congressional Record for January 14, 1901; and page 1096 of the Congressional Record for January 16, 1901 ..... 3595 2807
Exhibit No. 548—Map—"Railroads in relation to New River" ..... 3603 2812A
Exhibit No. 549—Album of photographs (original exhibit) ..... 3605 2813
Exhibit No. 550—Map "Geological Map of the New River, Cripple Creek region, showing the approximate location of ore openings and properties tributary to the Cripple Creek Extension of the Norfolk and Western Railroad, by E. N. D'In-Villiers, Geologist, 1887" (original exhibit) ..... 3605 2813
Exhibit No. 551—Letter addressed to Dr. J. E. Williams, Dean at V. P. I., Blacksburg, Va., dated February 2, 1936, and signed by R. J. Noell (original exhibit) ..... 3605 2813
Exhibit No. 552—Carbon copy of a letter dated March 2, 1926, addressed to Hon. R. J. Noell, East Radford, Virginia, and without signature except "Dean of the College" and bearing the initials "JEW" (original exhibit) ..... 3605 2813
Exhibit No. 553—Letter dated March 4, 1936, from R. J. Holden, Professor, of Virginia Polytechnic Institute, Department of Geology, Blacksburg, Virginia, addressed to Hon. R. J. Noell, East Radford (original exhibit) ..... 3605 2813
Exhibit No. 554—Album, together with the identification map and the 60 photographs of New River (original exhibit) ..... 3605 2814
Exhibit No. 555—Map showing locations of photographs, and photographs Nos. 114 to 127, inclusive, of New River (original exhibit) ..... 3605 2814

Record from D. C. U. S., etc.—Continued.
Defendant's exhibits—Continued. Original Print
Exhibit No. 556—Annual report of the President and Directors of the Board of Public Works to the General Assembly of Virginia, in pursuance of an act, entitled "An act creating a fund for internal improvements" (original exhibit) ..... 3605 2814
Exhibit No. 557—Pages 140 and 141 of the Journal of the Virginia House of Delegates for 1817–18 containing a portion of the report of the House Committee on roads and inland navigation brought in on January 21, 1818 (original exhibit) ..... 3605 2814
Exhibit Nos. 558–A–558–G—Map dated November 21, 1912, survey made by Major F. W. Alstaetter, Corps of Engineers. Sheets 1 to 7, inclusive, of the Alstaetter map dated November 21, 1912, marked, respectively, 558–A to 558–G (original exhibits) ..... 3606 2814
Exhibit No. 559—Pages from the Report of the Chief of Engineers for 1875 ..... 3606–A 2814
Exhibit No. 560—Report of Chief of Engineers, 1887 ..... 3607 2823
Exhibit No. 561—Report of the Chief of Engineers for the year 1888, pages 225, 226, 1760, 1761 (original exhibit) ..... 3612 2832
Exhibit No. 562—Report of the Chief of Engineers for the year 1889, pages 261, 262, 1961, and 1962 (original exhibit) ..... 3612 2832
Exhibit No. 563—Report of the Chief of Engineers for the year 1890, pages 235, 236, 2249, 2250, 2251 (original exhibit) ..... 3612 2832
Exhibit No. 564—Report of Brigadier General Casey, Chief of Engineers, United States Army, to the Secretary of War, dated November 16, 1894, to which is attached a third endorsement by Col. Craigbill's underlying report, and also a second endorsement ..... 3614 2832
Exhibit No. 565—Letter from the Secretary of War dated Dec. 16, 1903, transmitting letter from Chief of Engineers including report made by him on New River ..... 3618 2835
Exhibit No. 566—Memorandum to the Secretary of War by Gen. Black, Chief of Engineers, dated May 19, 1916 ..... 3623 2840
Exhibit No. 567—Page 1284 of the Annual Reports of the Chief of Engineers of the War Department, year 1917 (original exhibit) ..... 3634 2849
Exhibit No. 568—Copy of letter dated July 1, 1925, addressed to Mr. C. Bascom Slemp, and signed by O. C. Merrill, Executive Secretary of Federal Power Commission ..... 3634–A 2849

Record from D. C. U. S., etc.—Continued.
Defendant's exhibits—Continued. Original Print

Exhibit No. 569—Letter dated July 3, 1925, addressed to Honorable O. C. Merrill, Exec. Secy., F. P. C., Washington, D. C. and signed by C. B. Slemp (original exhibit) ..... 3634–B 2850

Exhibit No. 570—Letter dated October 24, 1925, addressed to the Federal Power Commission, Washington, D. C., and signed by Curtis, Mallet-Prevost, Colt, and Mosle ..... 3634–C 2850

Exhibit No. 571—Letter of October 24, 1925, addressed to Major General Harry Taylor, Chief of Engineers, War Department, Washington, D. C., signed by Curtis, Mallet-Prevost, Colt & Mosle, as counsel for the Appalachian Electric Power Co., or its predecessors ..... 3634–D 2851

Exhibit No. 572—Report of Major General Taylor, Chief of Engineers, dated December 29th, 1925, addressed to the Executive Secretary of the Federal Power Commission, Washington, D. C. (text of this exhibit is same as Government Exhibit No. 97) (original exhibit) ..... 3604–E 2851

Exhibit No. 573—"Defendant's Exhibit No. 505" identified by Col. Edgerton as a part of the minutes subsequently printed as the minutes of the meeting of June 1, 1927 (original exhibit) ..... 3635 2851

Exhibit No. 574–A—Photostat of letter of July 1, 1927, from Federal Power Commission, addressed to Curtis, Mallet-Prevost, Colt & Mosle, signed by O. C. Merrill, Executive Secretary bearing reference "Ep–739–VA Appalachian Electric Power Company" ..... 3635–A 2852

Exhibit No. 574–B—Certified copy of a part of the minutes of the 88th meeting of the Power Commission held on the first day of June 1927 ..... 3635–B 2852

Exhibit No. 574–C—"Federal Power Commission, Washington, D. C. License on Navigable Waters, Project No. 739, Virginia, Appalachian Electric Power Co." with it is a form of license consisting of 16 pages (original exhibit) ..... 3635–C 2853

Exhibit No. 575—Letter dated March 1, 1928, to Hon. Dwight F. Davis, Secy. of War, Hon. Hubert Work, Secy. of Interior, Hon. Wm. N. Jardine, Secy. of Agriculture, constituting the Federal Power Commission, and signed A. E. P. Co., by Curtis, Mallet-Prevost, Colt & Mosle (original exhibit) ..... 3635–D 2853

Exhibit No. 576—Letter dated March 5, 1930, to Lt. Col. M. C. Taylor, Chief Engineer, Federal Power Commission, Interior Building, Washington, D. C., and signed by F. W. Scheidenhelm (original exhibit) ..... 3635–D 2854

Record from D. C. U. S., etc.—Continued.
Defendant's exhibits—Continued. Original Print
Exhibit No. 577—Photostatic copies of pages 6, 7, 8, and 9, of the Tenth Annual Report of the Federal Power Commission for the year 1930 3635-E 2854
Exhibit No. 578-A—Letter dated October 3, 1930, to Gen. Brown, Chief of Engineers, and signed by F. E. Bonner, Exec. Secy. (original exhibit) 3636 2857
Exhibit No. 578-B—Letter dated October 10, 1930, to the Exec. Secy., F. P. C., Washington, D. C., signed for the Chief of Engineers, by Hugh J. Casey, First Lieut. Corps of Engineers (original exhibit) 3636 2857
Exhibit No. 579-A—Photostatic copy of letter dated November 5, 1930, to Exec. Secy., F. P. C. and signed by Lytle Brown, Major General, Chief of Engineers 3638 2857
Exhibit No. 579-B—Photostat of report entitled "Second endorsement U. S. E. O. Huntington, W. Va., Oct. 18, 1930, Div. Engineer, Upper Miss. Valley Division, St. Louis, Mo., signed by Major Herman, District Engineer." 3638 2857
Exhibit No. 579-C—Photostat copy of report on navigability of New River, Va. (Huntington District, August 29, 1930). Third endorsement office, Division, Engineer, Upper Miss. Valley Div., St. Louis, Mo., October 24, 1930, to Chief of Engineers, U. S. Army, Washington, and signed George R. Spalding, Lt. Col. Corps of Engineers 3638 2857
Exhibit No. 580—Memorandum dated October 21, 1930, entitled "Memorandum for Exec. Secy." and signed by J. F. Lawson, acting Chief Counsel (original exhibit) 3647 2865
Exhibit No. 581—Document dated October 30, 1930, entitled "Memorandum for the Sec. of Int., Acting Chairman," and signed by F. E. Bonner, Exec. Sec 3647-A 2865
Exhibit No. 582—Photostatic copy of letter dated November 8, 1930, to Hon. John G. Pollard, Gov. of Va., and signed by F. E. Bonner, Exec. Sec 3647-C 2866
Exhibit No. 583—Photostat of letter from Hon. John Pollard, Gov. of Va., to Mr. F. E. Bonner, Exec. Sec., F. P. C., dated Nov. 10, 1930 3647-D 2867
Exhibit No. 584—Letter Jan. 27, 1931, from Curtis, Mallet-Prevost, Colt & Mosle to F. P. C. re Project #739 (original exhibit) 3647-E 2867
Exhibit No. 585—Telegram dated January 28, 1931, from F. P. C., signed by George Otis Smith, Chairman, addressed to A. E. P. Co. (original exhibit) 3647-E 2867
Exhibit No. 586—Photostat of letter dated September 18, 1934, to Sec. of War, Washington, D. C., and signed by A. E. P. Co., by George N. Tidd, President 3647-F 2868

Record from D. C. U. S., etc.—Continued.
Defendant's exhibits—Continued. Original Print

Exhibit No. 587—Photostatic copy of letter dated October 9, 1934, to A. E. P. Co. and signed by G. H. Dern, Secy. of War ..... 3647–I 2871
Exhibit No. 588—Letter dated October 18, 1934, to Hon. George H. Dern, Sec. of War, and signed by George N. Tidd, President A. E. P. Co ..... 3648 2871
Exhibit No. 589—Letter dated September 18, 1934, to Hon. Frank R. McNinch, Chairman, F. P. C., signed by Appalachian Electric Power Company, by George N. Tidd, President (original exhibit) .. 3648–B 2873
Exhibit No. 590—Letter dated October 19, 1934 to Frank R. McNinch, Chairman, F. P. C., without signature but counsel for both sides agreed that it was signed by I. F. Millikan, General Counsel of the Company (original exhibit) ..... 3648–B 2873
Exhibit No. 591—Photostatic copy of letter to M. F. Millikan, American Gas and Electric Company, signed by G. W. Dineweaver, Secretary, Federal Power Commission, dated October 23, 1934 (original exhibit) ..... 3648–B 2873
Exhibit No. 592—Map showing locations of certain photographs from 61 to 118, both inclusive, of New River (original exhibit) ..... 3648–B 2873
Exhibit No. 593—Paper on which Prof. Thomas drew sketch of wave ..... 3648–D
Exhibit No. 594—Hydrograph representing a possible hydrograph of operation of the A. E. P. Co. plant during a rather severe peak load operation, showing the discharge from the plant in cubic feet per second at various hours of the day ..... 3649 2874A
Exhibit No. 595—Chart showing a wave drawn during presentation of testimony of Prof. Thomas ..... 3651
Exhibit No. 596—Diagram of triangular wave prepared by Prof. Thomas ..... 3651–A 2874B
Exhibit No. 597—Diagram by Prof. Thomas pertaining to principle of integrating model ..... 3651–B 2874C
Exhibit No. 598—Diagram by Prof. Thomas showing reduction of Waves ..... 3651–C 2874D
Exhibit No. 599—Chart upon which Dr. Mead made diagram in connection with his testimony, pertaining to stream flow (original exhibit) ..... 3651–D 2874
Exhibit No. 600—Chart bearing legend, "Profile New and Kanawha Rivers to Forks of New River and North Carolina to Ohio River, showing existing and and proposed power developments" ..... 3652 2874F

Record from P. C. U. S., etc.—Continued.
Defendant's exhibits—Continued. Original Print

Exhibit No. 601—House Document No. 306, 74th Congress, First Session, entitled "Ohio River, letter from the Sec. of War transmitting, pursuant to Section 1 of the River and Harbor Act approved January 21, 1927, and Section 10 of the Flood Control Act, approved May 15, 1928, a letter from the Chief of Engineers, United States Army, dated August 14, 1935, submitting a report, together with accompanying papers and illustrations containing a general plan for the improvement of the Ohio River for the purposes of navigation and efficient development of its water power, the control of floods, and the needs of irrigation" (original exhibit) ..... 3654 2874

Exhibit No. 602—This exhibit is the Table 45, Appendix A, referred to in the paragraph 263, page 146, of exhibit 601. The appendices to the reports otherwise embodied in House Document No. 306 (being exhibit 601) were not printed as part of that document (original exhibit) ..... 3654–A 2874

Exhibit No. 603—Photostat of cover page of document entitled "The Ohio River Chart, drawings and description of features affecting navigation, navigable depths and tables of distances for ... ributaries, compiled under the direction of ... Chief of Engineers, United States Army," and also photostat of page 267 of that document (original exhibit) ..... 3654–B 2874

Exhibit No. 604—Copy of letter dated June 13, 1936, from Mr. Baker to the late Sec. of War, Mr. Dern (original exhibit) ..... 3654–C 2874

Exhibit No. 605—Reply of S. D. Embick, Acting Secretary of War, to Mr. Baker, dated June 22, 1936 (original exhibit) ..... 3654–C 2874

Exhibit No. 606—Letter dated June 26, 1936, from Hon. John Paul to Secretary of War (original exhibit) ..... 3654–C 2875

Exhibit No. 607—Letter dated July 17, 1936, to the Hon. John Paul, from Mr. Woodring, Acting Sec. of War (original exhibit) ..... 3654–C 2875

Exhibit No. 608—Letter dated June 26, 1936, from Col. Conklin, addressed to the Kanawha Valley Power Company (original exhibit) ..... 3655 2875

Exhibit No. 609—Letter dated July 10, 1936, to U. S. District Engineer Office, Huntington, W. Va., signed by Kanawha Valley Power Company, Graham Claytor, Vice President, subject "Kanawha River Pool Fluctuations resulting from operation of the Marmet and London Hydroplants" ..... 3655–A 2875

| | Original | Print |
|---|---|---|
| Record from D. C. U. S., etc.—Continued. | | |
| Defendant's exhibits—Continued. | | |
| Exhibit No. 610—Letter dated July 28, 1936, from the War Dept., United States Engineer Office, Huntington, W. Va., addressed to Col. F. W. Scheidenhelm, and signed by John F. Conklin, Lt. Col., Corps of Engineers, District Engineer (original exhibit) | 3655–C | 2877 |
| Exhibit No. 611—Executive Order No. 6251, dated Aug. 19, 1933 (set forth in full at fol. 2900 hereof) | 3655–D | 2877 |
| Memorandum required by Rule 14, Section 7 | 3656 | 2877 |
| Clerk's certificate [omitted in printing] | 3657 | |
| Proceedings in the United States Circuit Court of Appeals for the Fourth Circuit | 3658 | 2878 |
| Docket entries | 3658 | 2878 |
| Appearance for appellee | 3658 | 2878 |
| Appearance for appellant | 3658 | 2878 |
| Argument of cause | 3660 | 2880 |
| Opinion, Chesnut, J. | 3661 | 2880 |
| Dissenting Opinion, Parker, J. | 3718 | 2922 |
| Decree | 3745 | 2943 |
| Order staying mandate | 3745 | 2943 |
| Order as to use of original transcript of record | 3747 | 2944 |
| Clerk's certificate [omitted in printing] | 3748 | 2944 |
| Order allowing certiorari | 3749 | 2944 |
| Stipulation as to printing of record | 3750 | 2945 |

2437 HAROLD A. THOMAS

CROSS EXAMINATION

Q. You spoke yesterday, I believe, about the wave from the Radford project being a 24-hour wave?

A. By that I meant in ordinary times such a tide or wave would be released once every 24 hours.

Q. Now, what would be the more forceful—a series of waves going down the river, one following the other, or an isolated wave, so far as the effect on conditions down the river are concerned?

A. I don't know what you mean by the word "Forceful" in that connection?

Q. Well, have power?

A. Do you refer to the amplitude?

Q. Yes—persistence, greater amplitude?

A. I would say an individual wave would have greater amplitude than individual waves of a series.

Q. And would it persist in volume more than a series of waves?

A. I think there would be a tendency for it to persist in volume more. I may qualify that by saying I think an individual wave would be detectable further down the river than the waves of a series. Its rate of reduction in volume, however, might be greater than the rate of reduction of any wave of a series.

Q. That being true, if the project were closed down on, let us say, Saturday afternoon, that last wave would be an isolated wave, would it not?

A. No, I would not call it an isolated wave, since it is adjacent to the Friday wave.

2438 Q. How about the Monday wave, would that be an isolated wave, the first wave going down?

A. No; that would be adjacent to the Tuesday wave.

Q. How would you describe an isolated wave? Under what conditions would an isolated wave arise?

A. Under conditions such as if the plant at Radford had been shut down for a considerable number of days, and then opened up, and then shut down for a period of days.

Q. Monday's wave would not overlap on Friday's wave, would it?

A. You are referring to a one-day shut-down?

Q. A shut-down of a day and a half—from Saturday noon until Monday morning?

A. Under those conditions it would overlap slightly.

Q. But very slightly, wouldn't it?

A. Rather slightly.

Q. If you had a holiday on Monday, like Labor Day, and you had Sunday and Monday and half of Saturday, there would not be any overlapping?

A. The overlapping would be slight.

Q. But there would still be overlapping?

A. I think the effect of a large wave is perceptible for several days, though smaller.

Q. When did you set up this integrating model that you spoke of for the Bluestone?

A. Late in July.

Q. Of this year?

A. Yes.

Q. How late in July?

A. I can't remember clearly on that. During the latter part of July.

Q. And, up to that time, had you ever been up New River?

A. No.

Q. Was it after you set up this model that you came to
2439 New River?

A. Yes.

Q. How much time after you set up the model?

A. Oh, my impression is two or three weeks.

Q. So that would have put you over into August, wouldn't it?

A. Yes.

Q. Is that since you came here to Roanoke and this stay here in Roanoke?

A. I made a trip to Roanoke, and from thence went to Charleston and spent a day or two along the Kanawha River; then returned to Pittsburgh, and then returned to Roanoke about a week ago.

Q. But you had made some of your tests before you came here the first time?

A. A part of the tests.

Q. Describe to the Court this integrating model? Is that it, an integrating model?

A. I call it an integrating model. The integrating model that I constructed of the Bluestone reservoir was made of sheet metal; it was about four feet long and eight inches deep, and three and a half inches at the widest part, which corresponded with the crest of the Bluestone dam. It was the general shape of the Bluestone

reservoir with the distorted scales. The vertical scale was not the same as the horizontal scale——

Q. (Interposing.) What was the vertical scale?

A. I did not finish my answer.

Q. All right.

A. The vertical scale was not the same as the longitudinal scale, and the breadth scale was not the same as the other two scales. The model did not represent the Bluestone River reservoir exactly, but approximately. I constructed the model to guide my
2440 own judgment and to check my methods in studying the 1930 series of waves and to check my analysis of the seiches, which might be caused in Bluestone reservoir.

Q. Then you did not construct this model simply for the purpose of assisting the Government in the Bluestone reservoir?

A. No; it had no connection with that.

Q. You constructed it to make sure of your studies?

A. To make sure that my conclusions were correct in this case.

Q. I thought you said Carnegie had been employed (and you as its head) to make a study of the Bluestone entirely aside from the question of this law suit?

A. Yes; we are constructing several models pertaining to the Bluestone for the United States Government. This was something entirely different.

Q. What was the length of this model longitudinally?

A. About four feet.

Q. And that four feet represented 36 miles, didn't it?

A. Yes.

Q. And that 36 miles is the extent up the river that you expect the pools at its head to be?

A. I would like to correct my last answer, in that it represents 30 miles at elevation 1,490. The 36 miles is at an elevation of 1,520.

Q. That 1,490 is the height at which the pool would be filled when there is usable storage, isn't it?

A. Yes; as I understand it.

Q. What was the width of the river that you had for this model?

A. I do not have that figure in mind now, but I obtained
2441 it from United States Geological Survey maps.

Q. What did you reduce the width to?

A. I had a width scale, which I do not have in mind now. It gave the width of the river, of the water, of about one inch, but I would not say it was exactly one inch.

Q. What did you figure the width of the river to be where you had the dam site?

A. I don't have that figure in mind now, but I scaled it on the geological survey map.

Q. Can you give it in percentage as compared with the longitudinal measure?

A. I do not like to give those percentages offhand, but in general——

Q. (Interposing.) Have you any data here that could help you?

A. I think I could look up and probably find my scale figures, and I might say that the scale is such that longitudinally 30 miles is represented by something a little less than 48 inches. Transversely, a half mile will represent roughly the maximum width of the Bluestone reservoir near the dam, and is represented by three and a half inches.

Q. What is the vertical proportion?

A. The depth of the reservoir, which is 125 feet, approximately, was represented by about eight inches.

Q. Well, would not, or would, that make your proportion about 100 to 1 with respect to the vertical and the longitudinal?

A. No; all three scales were different—vertical, longitudinal and transverse.

Q. Wasn't the width distorted in the ratio of about 100 times the depth?

2442 A. I can figure that, if you want me to.

Q. All right.

A. (Witness makes calculation.) According to my figures, the width scale is about 45 times the depth scale. According to my figures, the breadth scale is in the vicinity of one in nine thousand.

Q. How about the length scale?

Mr. JACKSON. Is that the relationship between the breadth and the depth scale, or is it a comparison of the distortion of the two scales?

WITNESS. I put it both ways.

Mr. JACKSON. Let me have those again.

WITNESS. In round numbers the breadth scale is one in nine thousand and the height scale is one in two hundred.

By Mr. THOMPSON:

Q. Have you given the distortion of the lengths in relation to the depth?

A. In round numbers the length scale is about one in forty-five thousand.

Q. Now, then, what is the relationship of the lengths to the depth scale?

A. That is 200 to 45 thousand which would be 1 to 225.

Q. And that was a distortion, was it, of about 225?

A. Yes.

Q. So you relied on a model in which one dimension was exaggerated 225 times with respect to another?

A. Yes. That sort of exaggeration is peculiar——

Q. (Interposing.) Now, I didn't say——

A. By the term "integrating model" I mean a model in which such distortions are present and in which the model is not
2443 a scale model of the river.

By Mr. THOMPSON:

Q. So, any result you got there, you would have to follow it up with mathematical refinement to a very great degree, wouldn't you?

A. There has to be a mathematical analysis relating the action of the integrating model to the action of the prototype—that is the actual river or reservoir. The principles of such an analysis are recognized and definite and reliable.

Q. What was the volume of the reservoir in your model?

A. Oh, I don't have that figure in mind.

Q. Do you know what the width of the reservoir was in the model?

A. The maximum width was 3½ inches.

Q. 3½ inches?

A. Yes.

Q. Your model in appearance in no way represented the prototype, did it?

A. No, not at all.

Q. Your results are subject to individual interpretation and approximation, aren't they?

A. I should say so, yes.

Q. So that one person might read these results in one way and another person in an entirely different way?

A. Competent persons who would understand the principles involved would get reasonably equivalent results.

Q. That is your opinion?

A. Yes.

Q. It involves a matter of judgment, too, doesn't it?

A. Yes.

Q. This model of yours, did it extend down the river beyond the dam?

A. No.

2444 Q. Why didn't you extend it down the river?

A. It was made simply to study the effect of seiches on the Bluestone reservoir.

Q. And nothing beyond that?
A. No.
Q. Then it had no use, or, I believe you testified, that you used it in your comparison of a study of the 1930 wave itself?
A. Not that model. That was another model.
Q. You had another model then?
A. Yes. I had three models in connection with the studies in this case.
Q. How about the other model? Did that extend all the way down the river?
A. Yes, I had one model extending all the way down the river.
Q. From where to where?
A. From Byllesby to London. The model was built from Byllesby to Winfield, but I did not fully complete the part from London to Winfield.
Q. How long was that model?
A. Approximately 50 feet.
Q. And representing what length?
A. It represented the length from Byllesby to Winfield. According to my memory, in a rough way that distance is 200 miles.
Q. What were your other dimensions?
A. The scales on that model were: Vertical scale, 1 to 100; longitudinal scale, 1 to 30,000; and transverse scale, 1 to 5,000.
Q. And you did not have the Bluestone dam in that model, did you?
A. No.
2445 Q. Is that what you call an integrating model?
A. Yes, that is what I call an integrating model.
Q. The distortion in that model was 300 in length to depth, wasn't it?
A. Yes.
Q. And, in other words, the exaggeration of the length was 300 times that of the depth?
A. Yes.

By Mr. JACKSON:

Q. "Exaggeration;" what does that mean increase or decrease?
A. By that I mean the ratio of the length scale to the depth scale is in the ratio of 300 to 1.

By Mr. THOMPSON:

Q. What was the bed of the stream composed of?
A. Wood.
Q. And it was perfectly smooth, was it?
A. No.
Q. How was it fixed?
A. It was roughened.

Q. Who advised you how to fix the bed of stream up in a rough way? Where did you get your information?

A. No one advised me.

Q. You had not been up here when you made the model?

A. No, but I had rating curves of the river at various gaging stations.

Q. Would those rating curves give sufficient accuracy to know the channel resistance?

A. Yes, they gave me the information to determine the channel resistance or roughness.

Q. Were they U. S. G. S. curves?

A. I don't know where they were obtained originally.

2446 Q. Where did you obtain them?

A. I obtained them in Mr. Schiedenhelm's office, in New York. I do not know the original source of those rating curves except from conversation that some of them were obtained from United States Engineers.

Q. Will you produce those?

A. I can produce them in two forms—either by copies of the notes furnished me or the originals furnished me.

Q. Well, let us have the originals.

A. (The witness procures papers.)

Q. May I see them, please?

(The papers are handed to Mr. Thompson.)

Q. You used how many stations?

Mr. JACKSON. What are the curves that were handed over?

Mr. GATCHELL. New River at Ivanhoe December 15, 1930;
New River at Ivanhoe August 11, 1927;
New River at Allisonia September 26, 1929;
New River at Dam Site A August 6, 1927;
New River at Eggleston October 1, 1920;
New River at Eggleston October 1, 1920;

Mr. JACKSON. Are they duplicates?

Mr. GATCHELL. Evidently.

New River at Eggleston October 20, 1914, to September 30, 1920;
New River at Glen Lyn August 10, 1927;
New River near Hinton December 1, 1923;
New River near Hinton without date;
Kanawha River at Kanawha Falls, West Virginia, October 27, 1928, to September 30, 1931.

All of the tables which I have just listed are tables prepared in the United States Geological Survey Water Resources Branch.

There was also handed over a rating curve for New River at Caperton, West Virginia, without date, prepared in the office of the United States Geological Survey, Water Resources Branch.

By Mr. THOMPSON:

Q. Did you have any more rating curves than these?

A. I don't think so.

Q. So what you had were rating curves at Ivanhoe, Radford, Eggleston, Hinton, Caperton, and Kanawha Falls; is that correct—and Allisonia?

A. And Allisonia.

WITNESS. How about Glen Lyn?

Mr. JACKSON. Glen Lyn was listed.

WITNESS. Rating curve at Lock No. 2 was furnished me, but I made no use of it.

By Mr. THOMPSON:

Q. These were all U. S. G. S. data, were they not?

A. Yes.

Q. So you were depending upon—Mr. Schiedenhelm gave you the data from the U. S. G. S. to make all those figures?

A. Yes.

2447 Q. He apparently relied on those figures, didn't he, when he gave them to you?

A. So far as I know.

Q. And you did, too, didn't you?

A. Yes; I considered them reasonably accurate, or approximately accurate, with the ordinary accuracy of such studies.

Q. Now, I believe some of these are figures taken 15 years ago, aren't they, of these data?

A. I did not make a mental note of those dates as you just read them.

Q. The one at Eggleston is dated from October 20, 1914, to September 30, 1020. There may have been records much later than those?

A. Possibly. I don't know.

Q. Are they not frequently changing the records, gathering new data, and so forth?

A. At some stations they do, and at others not.

Q. Did you use this one at Eggleston from October 20, 1914, to September 30, 1920?

A. Yes.

Q. Then you have one here at Eggleston from October 1, 1920, to blank; do you what the blank was?

A. No.

Q. So you were not any more careful than that. You took what was given you?

A. As I explained, this model was built to guide my own judgment. I did not consider it a model to report results with a high degree of precision.

Q. You were coming here to testify on the basis of this
2448 model, and you made all your assertions on the basis of the model?

A. No; my study was made of various things, including the model.

Q. You had not seen the physical condition of the river prior to studying the model, had you?

A. No; but I had seen the rating curve and the results of the 1930 wave tests.

X Q. Do you know anything about boulders down in that river bed, or did you, when you made this model?

A. I had no detailed information about boulders. I realized it was a rough river by the nature of the data I had on it.

X Q. How did you indicate this in the channel of the river in the model?

A. By adjusting the roughness so as to make the rating curves of the model agree with the rating curves of the river.

X Q. Do you put anything of a physical characteristic of the bed on the model?

A. Yes, sir.

X Q. What do you put?

A. Little sheet metal baffles which are inserted in the bed and walls of the channel, and which can be adjusted in and out of the slots to reproduce the correct roughness of the prototype.

X Q. How do you know about this roughness?

A. From the rating curves of the river.

X Q. And that is the only way you do it?

A. Yes, sir.

X Q. Do you know where Sandstone Falls are?

2449 A. Yes, sir.

X Q. Did you represent Sandstone Falls?

A. I adjusted the roughness of the model at the nearest gaging station upstream, which was near Hinton, and at the nearest gaging station below, which was Caperton.

The baffles near Hinton and Caperton were moved in and out until the model gave the correct rating curve at those stations.

I then ran tides down the model corresponding to the 1930 tides and checked the change in the profiles at those tides, and then adjusted the baffles between gaging stations so the model would reproduce the profile or hydrographs of the 1930 tides.

X Q. What was the fall at Sandstone Falls that you adjusted this to?

A. I did not show Sandstone Falls in that model, but just the general friction between Hinton and Caperton.

X Q. Isn't that simply theoretical judgment on your part?

A. An integrating model satisfies the mathematical requirement, it does not have to represent the river exactly. It is not a true scale model.

X Q. Aren't you exercising your own personal judgment, when you sit in a room with the model, adjusting and readjusting it?

A. Two persons expert in that work would arrive at the same result.

X Q. They would if they used the same judgment, wouldn't they? But wouldn't a man who had been over the river, and familiar, like Col. Scheidenhelm is with the river down in the gorge, have had a judgment far better than yours and more accurate in attempting to regulate the bed of the river on this model?

A. No. If I was to build it again it would be the same way, I would do it just the same way.

X Q. You don't think any number of trips on the river,
2450 or knowledge of the geology would help you?

A. No; because the fundamental data is the rating curve and wave test.

X Q. Then you throw yourself back absolutely on the rating curves?

A. And the wave tests and the profile and cross sections of the river.

X Q. On the rating curves you take the Geological Survey figures absolutely?

A. Yes, sir.

X Q. And depend on those entirely in that respect?

A. Yes, sir.

X Q. You don't question them at all?

A. I realize the Geological Survey figures are obtained by the use of current meters involving errors in the order of 5%, and occasionally more.

X Q. Now you adjusted the model until it gave the right answer, didn't you?

A. It showed—I reproduced certain waves of the 1930 series sent directly down the river.

X Q. At these various points you speak of?

A. Yes, sir.

X Q. Doesn't your result then only approximate the results on the river at the six stations selected by you?

A. I would hardly know what you mean by that.

X Q. You get only an approximate result?

A. I don't claim perfect precision on those results, but approximate.

X Q. It doesn't give any indication of conditions be-
2451 tween those six stations?

A. Yes, sir; something gives me indications of conditions between the stations, and that is the actual waves of the 1930 series.

X Q. So you have to come back each time to the 1930 series?

A. Yes, sir.

X Q. I want to get clear how many visits you have made to New River. When did you first see New River?

A. The first visit I made to New River?

X Q. When was that?

A. I guess about two weeks ago. I don't remember the date.

X Q. Where did you first see it, at what point?

A. At Radford.

X Q. And what time did you start from Radford?

A. Oh in the early morning.

X Q. And you were traveling by automobile?

A. Yes, sir.

X Q. Where did you go?

A. I crossed the New River at Radford—I started from Roanoke early in the morning, and crossed the New River at Radford, and went upstream to the Radford dam site and inspected that, and went from there to the Narrows, followed the river from the Narrows to Glen Lyn, and then along the bank of the river on a dirt road from Glen Lyn to Bull Falls, where I ferried across and followed the bank of the river to Hinton.

X Q. That describes somewhat the trip Mr. Putnam took. Were you with him?

A. No. I hadn't completed my answer. I then at Hinton took a road which crossed the river at Hinton and went through the mountains, behind the left bank of the river, and crossed the river again at a bridge a mile or so below the Hawks Nest
2452 hydroelectric plant. I then went up to the Hawks Nest plant and visited that and came back to the river and visited the power-station of the Hawks Nest plant and followed the river down from Glen Ferris and visited that station.

X Q. Was this all in one day?

A. No, it was not. I spent a night at a little town called Mount Hope, between Hinton and Charleston.

X Q. How many miles did you cover that day?

A. The rest of the trip was from Glen Ferris to Charleston. I spent the night at Charleston and came up the river again and spent the next day at the London and Marmet plant.

X Q. How many miles did you travel the first day?

A. The first day, going from Roanoke to Mount Hope I don't have a record of the mileage.

X Q. Several hundred, was it not?

A. I don't think so. My feeling is I went about a couple hundred of miles that day.

X Q. A great part of the time you were not in sight of New River, were you?

A. No.

X Q. So you only saw a few spots on the river from the project site down to Hawks Nest?

A. I was practically in continuous view of the river between Glen Lyn and Hinton, about thirty-six miles.

X Q. But up above that, there was about thirty miles you didn't see the river?

A. Yes.

X Q. These are the only times you have seen the river?

A. Yes, sir.

X Q. And when you made this experiment down at the London and Marmet dam, how long were you on that?

2453 A. During two days.

X Q. You were there two days?

A. Yes, sir.

X Q. Did you make the experiment or did someone make it for you?

A. The actual operating of the plant was done by the operatives, however, I laid out the test and directed the volume of water to be run through the plant, through successive hours.

X Q. That is the only time you ever made a test of that kind in your life?

A. Yes.

X Q. The only time you ever saw a test of that kind made?

A. So far as I know it is the only time a test of exactly this kind has ever been made.

X Q. Let us refer for a moment to Defendant's Exhibit #594. Do you have a copy of that?

A. I have the original which I picked up off the floor last night, marked for identification.

X Q. That curve is constructed on the basis of a 9,000 second-foot wave, is it not?

A. Yes, sir; a wave with that peak.

X Q. And you understand that is the way this Radford project is to operate?

A. I understand this is a possible way for it to operate.

X Q. It is possible for the Radford project to operate on a peak load of 9,000 second-feet part of the day and close down for the rest of the day in low water time?

A. Yes, sir.

X Q. And you understand this is the way it will operate from time to time?

2454 A. In this approximate way.

X Q. Now I notice first of all it says "Week day operation," that would indicate, would it not, there would be a different operation on Sundays and on holidays?

A. I should say so.

X Q. Then "3. Carrying reasonably allocated portion of A. E. P. Co. system load." What is the A. E. P. Co. system load let us say in October or November of any year, or taking 1935 for an example?

A. I can't answer that. I do not know what their total system load is. I have seen curves of that but did not make a memorandum of the total.

X Q. When they handed you this paper, Col. Scheidenhelm handed you this, didn't he?

A. Yes.

X Q. Did he explain to you what the reasonable allocation was, or did you just read that and take it and go on with it?

A. If I may explain, the detail of how this paper was received, I was in Col. Scheidenhelm's office in New York City when he called up the operator of the plant or system at Charleston, asking him to furnish him a reasonable load curve for the future operation of the Radford plant, and that, according to my memory, was the only requirement, a future load curve which might be reasonable for that plant.

X Q. That was this paper handed to you subsequently?

A. Yes, sir.

X Q. Who handed this paper to you?

A. Mr. Scheidenhelm or some of his associates.

X Q. Now you went ahead blindly with regard to this carrying a reasonably allocated portion, you didn't go back to find out if it was reasonable or unreasonable?

2455 A. No, except my judgment on that sort of thing tells me it is a reasonable curve.

X Q. How can your judgment tell you if you don't know what the load of the company itself is for any period of time?

A. No answer.

X Q. Supposing that were handed to you and you knew nothing about the load of the Appalachian Electric Power Company, how would you know whether that was reasonable or not?

A. It resembles other load curves which I have seen of systems which are not Metropolitan systems such as New York.

X Q. Isn't it true most of those systems their load curves are practically alike?

A. No, I would not say that.

X Q. You said they resembled it?

A. In a broad way.

X Q. And that is the basis for your conclusion this was a reasonable allocated portion?

A. I used the term reasonable in a general way. This is a reasonable load curve for such system, not in detail, but in general.

X Q. Would the Metropolitan load curve in New York be anything like this out here?

A. It might be quite different.

X Q. What systems does it resemble?

A. I don't think I can answer that specifically, but in my opinion it is a reasonable load curve for a system of a general type such as this system.

X Q. You must have some basis when they hand you
2456 a paper of this kind for saying whether it is reasonable.

As I understood you, you said something that you do not know about the load curve of the Appalachian Electric Power Company. Am I correct on that?

A. I have seen load curves of the company.

X Q. You don't know, do you?

A. I have seen load curves which I consider or have reason to think are reasonable, which resemble this approximately. There was one introduced in evidence in this case which I have seen which resembles this.

X Q. When did you see that?

A. Oh, recently.

X Q. Are you referring to Exhibit #226?

A. I don't know the number. (Exhibit #226 handed to the witness.) Yes, this is the one.

X Q. You think #594 resembles #226?

A. In a broad way, yes.

X Q. Is this #594 a chart of a part of a system load curve?

A. Yes, sir.

X Q. This shows, doesn't it, a variation from zero to 9,000 second feet?

A. Yes, sir.

X Q. So that you would understand the Appalachian Electric Power Company was going to discharge waves at the Radford plant from zero to 9,000 second feet, from this chart?

A. Yes, sir.

X Q. You will recall this Exhibit #226, and you said that there was a sufficient similarity between the curve on #594 to #226 so that you could draw the conclusion #594 was a reasonable allocated portion of the AEP Co., curve, is that right?

2457 A. In so far as the shape of the curve is concerned.

X Q. Is it any more reasonable than the curve you have shown on Exhibit #226, or are they sufficiently similar to be approximately alike?

A. I should say the latter, they are sufficiently similar to be approximately alike.

X Q. Would you say the mode of operation on #226 as indicated by that chart was as reasonable as the mode of operation on Defendant's Exhibit #594?

A. I can't say one is more reasonable than the other. In my opinion they are both of the same general type.

X Q. Yesterday you testified about two waves, one was a rectangular wave and the other was a triangular wave—that was #594.

A. By triangular you refer to this sort of wave?

X Q. Yes, sir.

By Mr. JACKSON. I don't think he called it triangular.

By Mr. THOMPSON. I called it triangular. I have a one track mind and it looks more like that to me.

By Mr. JACKSON. Just as long as we understand the wave doesn't mean triangular, it doesn't make any difference what we call it.

X Q. I believe that wave calls for 9,000 second feet discharge during eight hours?

A. The rectangular one.

X Q. What was the base length of that wave at Radford, of the triangular wave?

By Mr. JACKSON. That is #594.

A. 16½ hours if I am not mistaken.

X Q. Do you know what that length is in miles?

A. About fifty miles.

X Q. What was the base length of it at Glen Lyn, if you know?

A. I don't know exactly, but I would say it would be spread out so it would appear throughout the whole twenty-four hours to some extent.

X Q. Could you figure that out now?

A. No, not in any reasonable time.

X Q. Do you know what the base length would be at Hinton?

2458 A. The base length would be twenty-four hours.

X Q. At Hinton?

A. Yes; the wave would have a tail on it, so to speak, which would extend over the full twenty-four hours.

X Q. And that would include Kanawha Falls, too, wouldn't it?

A. Yes, sir.

X Q. What was the volume at Radford of this triangular wave, what would it be, the volume at Radford?

A. I can't answer that without computation.

X Q. Have you ever figured out what it would be?

A. I have made, or I can give you, a rough figure on that.

X Q. Suppose you figure that?

NOTE.—Last two questions read. [Witness figured.]

A. In my opinion it would be roughly 1,800 second-foot days.

X Q. That would be at Radford?

A. I figured that at Hinton. I had in mind you said Hinton. I have no quick way to figure that a Radford. It would be a long computation.

X Q. Didn't you assume [interrupted].

A. At Radford this wave is 3,000 second-foot days.

X Q. What would it be at Glen Lyn?

A. Oh, slightly, in my opinion, in a general way, about—slightly greater than at Hinton, say 2,000 second-foot days, or a little less.

X Q. Was this test being made through your model?

A. No; these figures I am giving you are figures I have in mind which are based on combination of the results I obtained from model tests, and studies of various waves of the 1930
2459 series. It is an opinion rather than a close highly precise computation, it is my general opinion, based on my general study of the problem.

X Q. Just give us an outline of how you arrived at that figure, I think you said 1,800 at Hinton?

A. Yes; roughly.

X Q. How did you get that figure?

A. By making a study of the rate of reduction of waves in the 1930 series tests, various waves, and also the rate of reduction of waves in my model test.

X Q. You can't give us any idea—I am very much of a novice on this and can't follow you—you can't give us any way you integrated these figures and had them separated and then embodied them together?

A. I obtained the result by studying the various waves of the 1930 series, whether they were adjacent to waves of similar size or separate, whether at high stage or low, and whether they were of large amplitude or small amplitude at the start, and by considering the results I got from my model.

X Q. Aren't the waves in the 1930 series totally dissimilar?

A. I would not say that.

X Q. What was the volume of this wave at Kanawha Falls, of your #594?

A. I don't have that figure in mind.

X Q. Will you give us that? [Witness made calculation.]

A. According to my figures, in a general way the volume of the wave at Kanawaha Falls would be in the neighborhood of 1,400 second-feet days. I do not consider that a close mathematical computation, but a general figure of about the volume of the wave.

X Q. That is approximately the volume?

A. Approximately.

X Q. Now let's take this other wave, the rectangular wave, that was for 9,000 second-feet and eight hours per day, was it not?

2460 A. Yes, sir.

X Q. The length of that wave would be approximately the same as the other one, fifty miles?

A. Well, not at the start.

X Q. At the start it wouldn't?

A. No, it would be eight hours length, at three miles an hour would be twenty-four miles at the start.

X Q. That would gradually expand until it got to be the same as the other covering a distance of about fifty miles?

A. Yes, sir.

X Q. What was the volume of that at Radford?

A. That was 3,000 second foot days at Radford.

X Q. And what at Glen Lyn?

A. I can only answer that in an approximate way. My opinion is it would be about 2,300 second foot days at Glen Lyn and about 2,100—you didn't ask that.

X Q. What would it be at Kanawha Falls; excuse me, I should have said Hinton?

A. Hinton, in my opinion, approximately 2,100. I started to answer that.

X Q. Have you figured it for Kanawha Falls?

A. In a general way. I should say the volume at Kanawa Falls would be about 1,700 second foot days. Again I will say that is not a precise mathematical calculation, but result based on a study of various things.

X Q. And that includes a study of the 1930 waves as a background?

A. Yes, sir.

X Q. And your test you made in your Laboratory?

A. Yes, sir.

2461 X Q. Anything else now?

A. No. Those are the principal things.

X Q. Now will you turn to Plaintiff's Exhibit #227 please. Do you have it before you?

A. Yes, sir.

X Q. You have studied that also, have you not?
A. Yes, sir.
X Q. Have you looked at wave #4?
A. Yes.
X Q. Take it at Radford, what was the volume of that wave at Radford?
A. This chart doesn't give the volume of it.
X Q. Can't you figure it yourself?
A. Not easily, no, it is quite an undertaking to figure the volume.
X Q. You had to do that, didn't you, to make your calculations with respect to the wave moving down the river?
A. I didn't figure volume.
X Q. Didn't you figure volume at all?
A. I figured volume at various times in the study, but not for the purpose of adjusting the model.
X Q. Isn't volume the most important factor when it comes to the question of effect on the river down below?
A. Yes, sir.
X Q. Did you figure volume?
A. Yes, sir.

By Mr. THOMPSON:

Q. What did you figure the volume to be, if you did figure it, of wave 4, at Radford?
A. 1,620 second foot days.
2462 Q. What did you estimate the height of that wave to be at Radford?
A. By height I assume you mean amplitude?
Q. Yes, amplitude?
A. 4,940 second feet.
Q. And on that map it would be about two feet high, would it not, that is, on Exhibit 227?
A. Yes, about two feet.
Q. 1,620 was the figure you gave in second foot days?
A. Yes, sir.
Q. Don't you think that is a little strong and should that not be about 1,500?
A. No, according to my figures Wave four, at Radford, has a volume approximately of 1,620 second foot days.
Q. Do you recall which diagram or chart you figured that from?
A. I do not remember the number of the exhibit, but I can show it to you.
Q. If you can give us that, I would like for you to do so?
A. It is Exhibit 138.
Q. Now we will go to Hinton and take Wave #4 on Plaintiff's Exhibit 227, and will ask you to figure the volume or amplitude and height in second feet, at that point?

A. Wave #4 towards Hinton I get the amplitude, 3,620 second feet, and volume of 1,720 second foot days.

Q. And can you give us the height in second feet?

A. The height in second feet was 3,620.

By Mr. JACKSON:

Q. That is the amplitude?

A. When you said height, Mr. Thompson, you referred to amplitude, I believe?

2463 By Mr. THOMPSON:

Q. Yes. Now we will move on down to Lock #2, and what is the volume there?

A. According to my figure the volume there is 1,400 second foot days.

Q. Will you give us the amplitude?

A. According to my figures, the amplitude is 2,600 second feet.

Q. Now while we are on Plaintiff's Exhibit 227, will you look at Wave #10, and having reference to the wave at Radford, please give us the volume of the wave at Radford and the amplitude?

A. I will have to look at the diagram for No. 10.

Q. All right, please do so.

A. I get amplitude 6,760 second feet and volume of 2,020 second foot days.

Q. What do you make it at Hinton for volume and amplitude?

A. At Hinton I make volume 1,630 second foot days and amplitude 3,990 second feet.

Q. What did you make it at Lock 2, the volume?

A. At Lock 2 I make the volume 1,350 second foot days and the amplitude 2,880 cubic feet per second.

Q. Will you please recheck the volume of the wave at Radford?

A. You mean #10?

Q. Yes.

A. The volume of Wave #10 at Radford is 2,020 second foot days. That consists of two parts, a small projection on the front of wave of 365 second foot days, and a larger part, 1,665 second foot days.

Q. Still looking at plaintiff's exhibit 227, and at Radford, you see where the black line comes down through there on the wave. Are you referring in your figures to the preceding small

2464 wave just above the words "Radford, Virginia," or to the following wave just to the right?

A. No; the one which is just to the left.

Q. That would be on noon of the 21st?

A. Yes, sir.

Q. Do you, in your reading, of this, consider that that preced-

ing part, that small wave just above Radford, is a part of the wave?

A. I consider that a part of Wave #10 because it is included in Wave #10 at Hinton and just below. Wave #10 overruns it and combines with it.

Q. Looking down below then at Hinton where the black line goes through the wave and up there at 22, would you say that little line as it rises or slopes up there, that that represents the effect or condition of the small wave referred to just above Radford, when it reaches Hinton. Do I make myself clear?

A. Yes; and I will answer the question "yes."

Q. That is the line from 10 a. m. to about 3 p. m.?

A. Yes, sir.

Q. And looking down there on the 23rd at Lock #2, the same effect is shown there where the line comes through from noon to 5 p. m.?

A. At Lock #2 there seems to be only a single wave, and there is no evidence of a smaller wave.

Q. It is the horizontal line from noon to 5 p. m. practically, isn't it?

A. I do not get that; it does not seem to me that way.

Q. Between 9 and 10, and between the line which separates 22 and 23, taking that point where the wave crosses that line and then looking back at the black line, wouldn't you call that practically a horizontal line?

2465 A. Yes; however, I do not think that horizontal part represents the small wave.

Q. Looking down at Lock #2 wouldn't you say that Wave #10 starts to rise at 5 a. m. on the 23rd.

A. About that; yes, sir.

Q. Would you not say that the small wave at Radford that we were referring to, just above the word "Radford" and at the Radford station, is indicated or shown when it gets down to Lock #2, in that short line, from midnight to 5 a. m. Do you get what I am referring to there?

A. I think I get it, but I don't know that I can answer that question definitely. The small wave seems to be obliterated at that point.

Q. The wave is blotted out but the effect of the wave is there, isn't it, in that horizontal line, isn't it indicated there?

A. I don't know that I can answer that question.

Q. If you were following the trend of the lines from Hinton to Lock #2 that would be indicative that that is this wave we have been referring to, this small wave at Radford, and then still smaller at Hinton?

A. Yes.

Q. What is the volume of the wave at Radford excluding the small wave we have been referring to?

A. According to my figures, it is 1,655 second foot days.

Q. What would it be at Hinton?

A. I have not separated the two at Hinton?

Q. What time did you start and finish your wave #10 at Hinton?

A. I started approximately 8 a. m. on the 22nd and terminated approximately 11 a. m. on the 23rd.

Q. Now going to Lock #2, on No. 10, what is the begin-
2466 ning and ending period for that wave?

A. The beginning is approximately at midnight between the 22nd and 23rd and ends about 9 a. m. on the 24th.

Q. Now taking the figures which you have given us at Radford and this Lock #2, and the ratio of the amplitude of Wave #4, is not the persistence there of that wave 53 percent in amplitude and the volume 87 percent?

A. If you will read me the figures you used in that, it will save a good deal of time in checking.

Q. 87 percent in volume?

A. I mean the actual figures?

Q. 1,620 second foot days at Radford, and 1,400 second foot days at Lock #2.

A. That was Wave #4?

Q. Yes.

A. How about Wave #10?

Q. It was 1,655 second foot days and then 1,350 second foot days.

By Mr. THOMPSON:

Q. Taking Wave #10 proper at Radford, and excluding the small wave, I am asking you to make your computation on that basis, and I am asking you to exclude that small wave and make your calculation, excluding it I understand it is 1,655 second foot days?

A. Yes.

Q. Excluding the small supplementary wave between waves 9 and 10?

A. I have no way of excluding it all the way because I have not considered it at Lock #2.

Q. You have not answered my question, have you?

A. What was the question now.

Q. Could you give us the persistance in volume of waves #4 and #10 from Radford to Lock #2, expressed in percentage?

Q. All right, give it for #4 first?

2467 A. Approximately 86 percent.

Q. Now Wave #10?
A. About 65 percent.

By Mr. JACKSON:

Q. Is that excluding the little wave at Radford?
A. No, that includes the little wave at both points.

By Mr. THOMPSON:

Q. Will you give it to us excluding it?
A. I have no way of excluding it at the lower station.
Q. If you follow the trend of lines of waves 9, 10 and 11, does not the small wave between 9 and 10 at Radford, fall into the horizontal line, midnight to five a. m., at Lock #2, separating waves 9 and 10 at Lock #2?
A. It does not seem to me that is the case. It seems to me that Wave #10 has overrun the small wave and that the small wave is included in Wave #10 at Lock #2.
Q. What is the explanation then for that horizontal line when the wave is at Lock #2 at midnight to five a. m.?
A. I don't know that there is any explanation of it.
Q. Would not your knowledge and experience of wave study tell you?
A. It seems to me when the crest was at the trough between Waves 9 and 10, it became somewhat rounded, but I would not say that the small wave is confined to the rounded part of the trough, or mainly in that trough.
A. Looking at the same wave on Exhibit 145, it is plain on that exhibit that the smaller wave has been combined with the larger wave at that point?
Q. Can you explain from this record, or this chart, or say that the small wave, call it 9½, has disappeared in Wave #10 below at Lock #2?
2468 A. It seems definitely at Lock #2, that the smaller wave forms a part of the main Wave #10. There is quite a dividing line between 9 and 10 at the left of the smaller wave.
Q. Referring to Government's Exhibit 141, look at five A. M. on the 23rd.
A. Is this the exhibit [indicating]?
Q. Professor, following wave No. 10 at Lock 2, will you agree that after five A. M. on March 23rd, this same wave No. 10 at Lock No. 2—is wave 10 at Radford the same wave 10 at Lock No. 2?
A. No, sir, that does not seem to me to be the case.
Q. Why not?
A. I don't know of any simple way of separating the small wave from the larger wave at Lock 2.

Q. How do you explain the horizontal line?

A. That is related in some way to the smaller wave, but I would not say that the volume under that line would represent the volume which could be attributed to the smaller wave at Lock 2.

Q. Professor Thomas, what was the persistence in amplitude of wave No. 4 between Radford and Lock No. 2.

A. You mean expressed—in what way do you mean?

Q. In percentage?

A. In percentage—assuming the figures you read to me are the ones that I testified to?

Q. Yes, sir.

A. It would be about eighty-six percent.

By Mr. JACKSON:

Q. That is in volume?

A. Yes, sir.

By Mr. JACKSON. I thought the question was changed. You have given that. You have not given him the figures, Mr. Thompson. You will have to give them to him.

By Mr. THOMPSON. They are 4,940 and 2,600.

By Mr. JACKSON. For what?

By Mr. THOMPSON. Radford is 4,940 c. f. s.

By Mr. JACKSON. I have 4,950; no, 4,940 is correct. What is the others?

By Mr. THOMPSON. Lock 2 is 2,600.

Q. What was it in percentage?

A. For a wave?

Q. The amplitude of No. 4?

A. The amplitude of No. 4 at Lock No. 2?

Q. Lock No. 2?

2469 A. Lock No. 2, the figure I testified to was 1,400.

Q. That was the volume figure?

A. Oh, you want the amplitude?

Q. Yes—4,940 and 2,600.

A. About fifty-two and a half percent, assuming the figures you gave me are correct.

Q. On your Exhibit 594, you gave figures showing an amplitude of 39 percent persistency, didn't you?

A. I do not have that data at hand, but what is that exhibit?

Q. That was Exhibit 594.

A. Yes, sir; that was Exhibit 594.

A. I cannot find my memorandum as to what I testified as the amplitude at Kanawha Falls.

Q. Can you get those figures?

A. I can get the volume.

By Mr. JACKSON:

Q. Can you look at the two figures that Mr. Thompson wants to compare?

A. I think the one he wants is 9,000 second feet.

By Mr. THOMPSON:

Q. With respect to the rectangular wave that you described, you have 9,000 at Radford and 4,000——

A. (Interrupting.) Yes, sir.

Q. (Continuing.) At Kanawha Falls.

A. Yes, sir.

Q. Which would make a persistency of 45 percent?

A. Approximately 45 percent.

By Mr. JACKSON:

Q. Forty-nine percent?

A. Forty-five percent.

By Mr. THOMPSON:

Q. So that your test waves or your waves that you have testified about rather, did not have the same persistency that wave 4 had on the test in 1930?

2470 A. No, sir.

Q. Professor Thomas, in order to create an oscillation, would you not discharge a large volume of water in the Marmet pool and suddenly cut it off, to make an oscillation in the Marmet pool?

A. Would such an oscillation be caused in that way?

Q. Yes, sir.

A. Yes, sir; that would be a way to cause such an oscillation.

Q. You testified yesterday that you created a wave fifty-percent greater and similar in shape to the 1930 tests of wave No. 2 at the London Dam; that you ran this wave through the Marmet pool, maintaining as nearly a constant level as possible in the Marmet pool. Is that correct?

A. Yes, sir.

Q. Did you observe any oscillation in the Marmet pool?

A. Yes, sir, there were oscillations.

Q. Isn't it a fact that the conditions you laid down here would prevent an oscillation—in other words, if you allowed practically the same amount of water to come into the pool that was going out, wouldn't you prevent an oscillation?

A. No, sir, you could have an oscillation with no flow at all through the pool.

Q. How would you create the oscillation?

A. Going back to the old illustration, just as you would create an oscillation in a plate of soup; you could have it without any flow through it.

Q. Yes, sir; but if you have a pool kept at a certain level and have the same amount of water coming in there and going out, how could you create an oscillation?

A. By suddenly increasing the inflow or decreasing it—a decrease in outflow or inflow.

Q. Would you call that an oscillation?

2471 A. I don't think the question clear—call what?

Q. An action of that kind in the Marmet pool.

A. I should say that such an oscillation was created—if it was created in that way, you would call it an oscillation.

By Mr. THOMPSON:

Q. Is that what you call an oscillation when you use the word seiche?

A. Yes, sir; by seiche, I mean a condition in which the water at one end of the reservoir, or both ends of the reservoir, oscillate up and down.

Q. Do you understand that water, under conditions of that kind, goes over the top of the—let us say the Marmet Dam.

A. It might or might not, depending on the height of the oscillation and the height of the water with respect to the top of the dam before the oscillation started.

Q. What is the normal pool level of Marmet with respect to the height of the dam?

A. I don't know—you mean with respect to the crest of the dam?

Q. Yes.

A. As I understand it, about 0.3 of a foot is allowed for variations; the pool level is supposed to be kept within 0.3 of a foot of the top of the dam.

Q. And it is supposed to be kept constant.

A. As nearly as practical.

Q. How is it possible to have any oscillation, if you have the same amount of water going in and the same amount going out?

A. Because an oscillation does not depend on the inflow or outflow; it simply depends on the travelling of the waves up and down the pool.

Q. Didn't you say yesterday that an oscillation is created by sudden inflow?

A. A sudden change of inflow or outflow.

Q. Would you change the level of your pool if you let the same amount of water go out that was coming in?

2472 A. I cannot answer that in a short way. Assuming that both stations are operated and the pool levels are constant and both shut down at the same instant, you then would produce a condition that would create an oscillation—the flow at both

stations would be the same, but yet an oscillation would be produced.

Q. When you made the tests at Marmet, did you do that—close both pools at the same time?

A. No, sir.

Q. I mean stations?

A. No, sir.

Q. You testified on page 5701—strike that out. Assuming a three foot draw down at London pool eliminated, assume London and Marmet and Winfield maintained at fixed pool levels, assume a wave of 4,100 second feet entering London pool, will not this wave pass through London pool into Marmet pool and through Marmet into Winfield and beyond Winfield into the Ohio undiminished in volume and amplitude?

A. I remember such a question. I would like to look at my record [witness examines paper]. Is that the wording of a question asked, or a direct question that you are asking me now?

Q. No, I am asking you now. It is on page 5701 and 5702.

A. I misunderstood you.

2473 By the COURT. Go ahead, if you can answer it.

By the WITNESS. I should say that, if the pool remained at a mathematically constant level, with absolutely no variations, the waves would pass through undiminished, but with ordinary routine variations, the waves would be completely absorbed and obliterated by the operation of the power plants. The Court called attention to that yesterday afternoon, and I called attention to the fact in my testimony that two inches of variation in the level of Winfield and Marmet would be sufficient to completely re-regulate those waves, and in the case of the Gallipolis pool, a variation of three-fourths of an inch would be enough to completely re-regulate it; and in the case of the Marmet pool, I know that variations of 0.3 of a foot are permitted to occur frequently and normally, and I feel justified in assuming that somewhat similiar variations will be permitted in other pools, and so my opinion is that it is utterly improbable that these waves would be transmitted through that series of navigation locks into the Ohio.

Q. If they are transmitted through the power plant, aren't they transmitted?

A. They are completely obliter'ed in transmission through the power plant.

Q. I cannot call that wave "A" or wave "B," but that volume of water goes through the power plant, doesn't it?

A. It will be re-regulated through the power plant; it will pass through there uniformly or intermittently.

Q. If it did not pass through the power plant, what would happen, in Marmet, for example, with this wave?

A. I don't think that is clear.

Q. It seems very simple. You have a wave into Marmet of 4,100 second feet?

2474 A. Yes, sir.

Q. And you say it is re-regulated?

A. Yes, sir.

Q. Suppose that the power plant was shut down, what would happen to that?

A. You would have to open the roller gates to keep them from overflowing.

Q. And it would go through, wouldn't it?

A. Not the original wave; some discharge from the roller gates.

Q. The wave itself would go through, 4,100 second-feet would have to go through there or it would spill over?

A. It would go over or through the gates.

Q. If it didn't go through the gates, it would spill over the top, then?

A. Yes, sir.

Q. If you get a constantly fixed level, you would have to let it go through the gates, wouldn't you?

A. If you kept a mathematical level; if you permit variations of a few inches, then it would not have to go through. Variations of pool level would be sufficient to re-regulate it.

Q. Getting back to my question: if this 4,100 second-feet were coming into the pool, you would have to open the gates to let it through or have it run through the power plant, wouldn't you?

A. As I said, the London pool would completely absorb that wave; it would absorb a wave two or two and a half times as large, and it would not have any effect below London.

Q. Coming back to the London pool and assuming that the London pool has a fixed point at the top, assume that we do not have the three-foot draw-down and water comes into the

2475 London pool, supposing the power plant closed down—what would happen?

A. Either the gates would have to be opened or the water would spill over the top.

Q. The waves would go through, wouldn't they?

A. Greatly reduced in amplitude.

Q. Why would they be greatly reduced in amplitude?

A. Because, to spill over the top of the dam, it would have to build up a head to the top of the dam several inches and that would store the water.

Q. It is considered good practice or practice that is countenanced to let water go over a dam of that kind?

A. No, sir.

Q. What you would do would be to open the gates and let it go through?

A. Yes, sir.

Q. Wouldn't this wave go on down through there that we are speaking about—this 4,100 second-feet?

A. It would cause a rise of a couple of inches in the pools below.

Q. Wouldn't that wave go on through down to the next pool?

A. Yes, sir.

Q. If you did not open the gates and wanted it to go through, they would have to let it go through the power plant, wouldn't they?

A. Yes, sir.

Q. Well, that is not re-regulation, is it?

A. If the water in the pool is permitted to rise as the wave comes into it, that is reregulation.

Q. Do you mean to tell the Court that letting that water go through by way of the dam or the gates, or by way of the
2476 power plant, is reregulation?

A. I may say any operation which causes the levels to fluctuate will produce a condition where there will be reregulation and will obliterate the wave.

Q. You can call it any names that you wish, but you have to let the water go through—the 4,100 second-feet or it will go over the top, will it not?

A. It depends on how much of this is drawn down at the beginning.

Q. We are saying that there is a fixed level there and that the pool is filled.

A. Yes, sir, in that case——

Q. (Interrupting.) It has to go over the top?

A. It has to go over the top or through the gates.

Q. Or through the plant?

A. Yes, sir.

Q. And would go that way past each dam?

A. If the pool levels were maintained at a mathematical constant level, it would go through; if the pool levels were not maintained

that way, the wave could be reregulated in any possible way—in many ways.

Q. You spoke of some minor fluctuations that you saw when you were making these experiments or studies at Marmet?

A. Yes, sir.

Q. I believe you named the operation of the locks?

A. Yes, sir.

Q. And then the operation of the roller gates?

A. Yes, sir.

Q. And gusts of wind?

A. Yes, sir.

2477 Q. I believe you said that there was one operation of the locks while you were there?

A. Yes, sir, at London.

Q. And there were no other operations of the locks.

A. No, sir; there were other operations that day, but not while I was there. As I recall it, the records showed there were lock operations that day, but not at the particular time while I was there.

Q. So that one operation could not account for an increase in the rise of water in the pools below, could it—that one operation of the locks?

A. Such a rise occurred immediately after the lock operation.

Q. Don't you know, as a matter of fact, that that boat that you speak of was going upstream, rather than down stream, that was being locked?

A. I think it went the other way, if my recollection is correct. I saw it coming out of the lock. However, I can check my records on that. [Witness examines paper.]

A. The lockage that I observed was on August 14th at two o'clock P. M.

By Mr. THOMPSON:

Q. On August 14th at two o'clock P. M.?

A. I have two records on this and this one [indicating] does not check with my records. I will have to look at the other one.

Q. Do you know what the one that you have there says?

A. The one I have—this record [indicating] does not show a lockage on the 14th. [Witness examines additional papers.] On August 14th, at 2.35 p.m., upstream.

Q. Then there would not be any flow of water down stream in locking upstream?

A. They may have prepared that lock for that boat just before it cam through. I assume that was the cause, but I

2478 did not verify that. There was a definite rise in the pencil at that time as I came in and a boat was at the lock.

Q. You have your records there; there was not any other lockages?

A. On that day, one at five P. M. downstream at London and two upstream about eight o'clock P. M.

Q. After the tests were made?

A. That was during the period of the tests.

Q. Did you see that lockage?

A. No, sir; the only one I noticed was at 2.35 P. M.

Q. It was not a gusty or windy day when you were there, was it?

A. No, sir; but in the latter part of the afternoon, it became somewhat windy, and I noticed definitely an increase in the fluctuations in the pencils of the gages, as conditions became slightly windy. There was no strong wind, but a definite breeze came up during the latter part of the afternoon.

Q. There was not much indication of it?

A. No; as soon as the breeze came up, the pencil of the gage began to fluctuate from 0.05 to a 0.10 of a foot.

Q. Were the roller gates up when you were there?

A. The roller gates at Marmet were up three inches for a short period during the test.

Q. That was very small?

A. Yes, sir.

Q. Then it must have been a discharge of the turbines that caused the wave and was not these oscillations you speak of?

A. The minor oscillations you refer to?

Q. No. The minor oscillations were not caused by the
2479 the three conditions I referred to.

A. Yes, sir; these minor oscillations were caused by the three conditions you refer to: Lockages, taking a load off, blocks of load and by wind; and there was a small gate operation, but it did not produce any surge that I could detect.

Q. Can you give us the time when these gates were operated?

A. I don't know that I have a record of that. [Witness examines papers.] It was during the night. I think it is in the record, but I will have to take time to find it.

2480 Q. On what studies or observations do you base your Statement that power tides or waves rise and fall slowly?

A. In this case, I based it on the studies of the 1930 series of waves or tides.

Q. Have you ever studied any other power waves?

A. Not intensely, the way I have these.

Q. So you really do not know their characteristics?

A. Well, my opinion is that general hydraulic knowledge tells you a great deal about the characteristics of such waves in general. They are not greatly different from rain waves.

Q. Well, if your studies were general, your conclusions would be general also, wouldn't they?

A. Well, I don't think so. I think my studies in general give me the training to interpret these specific cases.

Q. What method did you employ in calculating the rate of flow obtaining during your tests at the London and Marmet dams?

A. Multiplied the kilowatts generated at the station by certain factors which were obtained by the test curves for the units.

Q. Do you mean——

A. The turbines and generators.

Q. Are you familiar with what happens to the discharge of a hydro plant when a breakdown occurs on the transmission lines connecting that plant with a system load?

A. Yes.

Q. What happens?

A. The turbine governor will close the gates.

Q. And the load drops very suddenly?

A. Yes. You speak of it as an open circuit?

Q. Yes.

A. Yes.

2481 Q. Supposing that the Radford plant were operating and discharging 9,000 second-feet, and the plant suddenly closed down (that is, the transmission line suddenly closed down), wouldn't there be an immediate cessation of discharge of water also?

A. A very quick cessation, yes.

Q. You were speaking about silt depositing in the pools: Do you know that recent observations at Boulder Dam show that silt in water entering the upper region of the reservoir followed a subsurface channel to the dam and passed through the openings at the dam with little decrease in silt content?

A. I had not heard that.

Q. You had not heard that?

A. No.

By Mr. THOMPSON:

Q. You stated that, in your opinion, the out-flow from the London dam, on June 10, 1936, at 2 A. M., was not 11,000 second-feet, as shown on Government Exhibit 229. In your opinion, how much was the outflow at that time?

A. I have no easy way to determine that exactly.

Q. How did you know that it was not 11,000 second-feet?

A. I think I said it was improbable it was 11,000 second-feet. According to my recollection, I said there was an oscillation in the pool at that time, and the ordinary relation between stage and discharge did not hold.

Q. But that was just simply a surmise of yours. It is not based on actual knowledge, is it?

A. No. The fact that the discharge stage relation did not hold during a period when seiches are occurring is based on actual knowledge, and because of this fact I could not say positively whether or not it was 11,000 feet at that particular instant, but I think it highly impro'able that it was.

Q. Didn't you say that that little up-raise there of what looks like a finger standing at the top of the wave, Exhibit 591, was caused by lockage?

2482 A. I think I said in my opinion it was probably caused by lockage.

Q. You are not sure about that?

A. No. I cannot be positive of that, for one thing, because of the uncertainty of time in this record. I think that its relation to other storages caused by lockages are equal. I think that this probably was caused by a lockage.

Q. It might have been caused by some other reason, might it not?

A. Well, it seems to be improbable it was caused by any other reason.

Q. Do you know what the total power generation at the London dam was between 9 and 10 A. M. June 16, 1936?

A. I have the data by which that could be determined.

Q. Can you give us that? Have you got it handy?

A. I have a continuous record of the operation of that plant which, I think, shows that date. Would you like to have it?

Q. If it is not too much trouble, you can get it right now.

A. Between 9 and 10. Do you want the total between those two hours, or the individual hours?

By Mr. THOMPSON:

Q. The kilowatt hours between 9 and 10?

A. 15,000.

Q. What was the corresponding discharge for the same hour?

A. I can obtain it quite closely by multiplying by .62, if that will be close enough.

Q. All right.

A. About 9,300 second feet.

Q. Is that an average for an hour?

A. That is an average for an hour.

Q. Is it not reasonable that the maximum during that hour might be as much as 11,000 feet, as shown on Exhibit 229?

A. No, it is not.

Q. You do not think that is reasonable?

A. No.

2483 Q. You spoke about the fact that if the roller gates were open it might be a very serious disturbance created down in the London and Marmet dams?

A. Yes.

Q. You think there is any conceivable chance that the roller gates would be operated in that way by the United States Engineers?

A. No, I do not.

Q. Your 1930 test waves had relatively short crests, did they not?

A. Do you mean at the point of beginning, or further down the river?

Q. At Radford?

A. Yes, at Radford.

Q. Would you not expect waves from Radford having a broader crest, as shown in Government Exhibit 225, to be much more persistent?

A. The question is not complete enough to answer it.

By Mr. THOMPSON:

Q. That is having a broader crest?

A. Having the same volume?

Q. Yes, having a volume shown on Exhibit 225?

A. 226 the exhibit is.

Q. 226; pardon me.

A. I see no reason why they should be more persistent.

Q. A wave with a broader crest, wouldn't that be more persistent?

A. Not necessarily.

Q. Would the fact that the waves started probably 40 miles further-down-stream not make them more effective, or more persistent, when they reached Lock No. 2?

A. I don't think so, assuming the same discharge at the starting point?

Q. So distance does not make any difference; is that the idea?

A. I understood you asked me if they were traveling by the same distance and having the same volume at the start.

2484 Q. No. I did not mean starting the same distance, because I eliminated the 40 miles between Buck and Byllesby and Radford.

A. What is the question?

Q. Don't you think a wave of the same size, starting from Bluestone, for example, and traveling down the Kanawha Falls, would have a greater effectiveness or persistence, if you use that word, than a wave of the same size starting from Radford?

A. I don't see why it should have more persistence. Do you mean the rate of decrease?

Q. Yes. For example, it would not be flattened out as much as if it had traveled a shorter distance?

The COURT. Do you understand the question?

WITNESS. It is not entirely clear exactly what you mean. The rate of decrease, I think, might be the same in both cases.

By the COURT:

Q. Let me ask, supposing a wave of certain dimensions was released up at the Buck Dam, and a wave of the same volume, under the same conditions, was released down at the Radford dam on separate occasions, in order to make a comparison; when it finally got down to Kanawha Falls, wouldn't the wave from Buck dam have been distributed or flattened out more than the other?

A. Yes, indeed.

By Mr. JACKSON:

Q. There was confusion about the rate of decrease?

A. Yes, sir.

By Mr. THOMPSON:

Q. Would not a wave, such as is shown on Government Exhibit 226, starting from Radford, have more persistence on arrival at Lock No. 2, both in amplitude and volume, than a wave of a similar size (than the wave shown on Defendant's Exhibit 594) starting at Radford and going down as far as Lock No. 2?

2485 A. Do you refer to these waves as compared to that one?

Q. Yes.

A. In my opinion the two are essentially similar. There is no outstanding distinction between them. I could not say which would have the greater persistence.

Q. Doesn't the wave on Government Exhibit 226 approach the ideal of persistency more than the wave on Defendant's Exhibit 594—that is as to shape?

A. I do not see any essential difference between those two waves.

Q. Professor, do you know what the drainage area at Radford dam site is?

A. I do not have the exact figure in my mind, but approximately. I can look it up.

Q. Is it not 2,283 square miles?

A. Something on that order. The figure I have is 2,400 square miles.

Q. All right. What is the total drainage area of the Kanawha water shed?

A. At Kanawha Falls?

Q. Yes.

A. You asked the Kanawha water shed.

Q. What is the total drainage area of the Kanawha water shed? Strike out "at the falls."

A. Very nearly zero.

Q. The entire water shed?

A. At Kanawha Falls the water shed above Kanawha Falls, including the New and Gauley Rivers, is 8,375 square miles.

Q. What is the water shed of the entire Kanawha River?

A. The figure I have at Point Pleasant, West Virginia, is 12,245 square miles.

2486 Q. If the records of the United States Geological Survey show the mean flow of the Kanawha River, at Kanawha Falls Gage, to have been 1,130 second feet for the month of October, 1930, and if the testimony given in this case by Mr. C. H. Pierce, Senior Engineer of the Geological Survey, shows the mean flow at the Radford dam site to have been 759 second feet for the same month, would you question those figures as substantially correct?

Mr. JACKSON. I object to that question. There is no testimony of that.

The COURT. He may answer it.

Mr. JACKSON. Exception.

A. I see no reason in the figure itself why it could not be possible. Of course, I have no knowledge as to the actual flows at that time.

By Mr. THOMPSON:

Q. You see no reason to question them, though, do you?

A. I think I can't answer it any more clearly than I did.

Q. On the basis of these figures, is it not true that slightly more than two-thirds of the water that passed Kanawha Falls Gage, during that month, came from above Radford dam site?

A. I should say in the vicinity of two-thirds.

Q. You have read, I believe, Government Exhibit 145, being House Document No. 91, 74th Congress, First Session, have you not? That is known as the 308 report on the Kanawha River.

A. I have not read it thoroughly, but parts of it.

Q. If you were responsible for navigation on the Kanawha River during a period such as 1930 and the London and Marmet dams were in operation, would you be willing to cut off the flow of the watershed from above the Radford dam during a month such as October, 1930?

By Mr. JACKSON. I object to that question, because not proper cross examination; has no relation to the examination in chief; and this witness has not qualified as to navigation.

By the COURT. I don't see the objection from that standpoint, but I think the question has a very incomplete foundation.

By Mr. JACKSON. I should also like to object for the reason it doesn't specify the length of time of cut off.

By the COURT. As I said it has a very incomplete foundation.

By Mr. THOMPSON. I will make it for any length of time at the Radford dam.

By Mr. JACKSON. For a minute or more.

By Mr. THOMPSON. We will not consider a minute. I don't think that is sensible.

By Mr. JACKSON. I object unless something that is sensible is substituted then.

By Mr. THOMPSON. We will make it forty-eight hours then.

By Mr. JACKSON. I still object to the competency of the question.

By the COURT. He may answer.

By Mr. JACKSON. Exception.

2487 A. I think if I had the power to prevent the water from being shut off under those conditions I would exercise it.

Q. Have you hydrograph showing the fluctuations at the upper ends of the pools below the London and Marmet dams during the test of October 14 and 16, 1930?

A. Yes, sir.

Q. Could we have copies of those?

A. Yes, sir.

By Mr. JACKSON. We will supply them.

By Mr. THOMPSON:

Q. May we also have a report of the operation of the power plant when you made your test?

By Mr. JACKSON. You mean the record of the operation?

By Mr. THOMPSON. Yes.

A. I have only a single copy of that.

Q. How soon could we get a copy?

A. I have only one copy.

Q. Could we borrow it this evening?

By the WITNESS. So far as I am concerned.

By Mr. JACKSON. We will try to get you a copy.

2488 Redirect examination by Mr. JACKSON:

Q. Professor Thomas, I think you testified you began your integrating model tests in the latter part of July of this year. Have you since that time refreshed you recollection as to the accuracy of that time?

A. I think it was early in July, in the early part of July.

Q. Do you happen to know whether it was before the opening of this case on July 13th?

A. Yes; it was before July 13th.

Q. Will you explain to the Court the principle of the integrating model?

A. Such a model is a model of some hydraulic structure which does not resemble the structure closely physically, but satisfies the same mathematical equation. I think I can best explain the principle by using the chart. [Witness indicated on chart.]

Line "b" represents the bed of the river; line "s" represents the surface of the water, and we can give consideration to any cross section of the river. At that cross section there is a definite and well-known relation between the velocity of the water, which I will represent by "v"; the hydraulic depth which I will represent by "r" and the elevation above sea level, which I will represent by "z," and the distance measured from any arbitrary starting point to give horizontal distances, which I will designate by "x," and we will consider a slice at right angles to the river
of one-foot thickness. Now the well-recognized and
2489 adequate relation among those things can be expressed by a formula applied to that slice one-foot thick. Although I realize there are non-technical persons here, I think if I write the formula down it will convey the idea I am talking about. The formula is that the velocity square divided by 2.21 times the hydraulic depth to the 4/3 power, times the roughness factor squared is equal to delta z, which is the rate of rise of the water surface divided by delta and v over g times delta v over delta x, which is the rate of change in the velocity times the velocity, and 1 over g times delta v over delta t. I wrote that formula just to show I am talking about something definite, and not something very general or vague.

Q. Was that a definite mathematical relationship?

A. That is a mathematical relation that takes into consideration the rate of rise of the river surface at that point, which is vital in understanding these waves.

Now in order to solve that for the whole river you have to satisfy that condition for every foot wide you have all the way down the river, which is a tremendous job.

Now if you have a model of that river you could predict the flow through that model by the same equation if you had the problem given you.

Those principles are explained in Durand's book on "Flow in Pipe Lines" and are also explained in Freeman's "Hydraulic Laboratory Practice" and also explained in various other places.

The fact there is this relation between the model and prototype makes it possible to distort the scale of the model and still obtain reliable results from the distorted model.

If the model although distorted had perfect representation of the prototype at every cross section the results of such model
would be perfect. If you cannot build your model abso-
2490 lutely perfect with respect to representation of the cross

section you nevertheless can get satisfactory approximate results depending on how closely and accurately the model is made.

Q. Now will you explain about the gages on the model, are they sensitive or otherwise?

A. In making a small model, the most satisfactory way to measure the variations in depth of the water in the model is to use an inclined gage, simply a glass tube inclined at an angle, and chemically cleaned up, so as to be absolutely clean, and that glass tube multiplies the fluctuations of the water surface, so with a model eight inches deep it is possible to represent the water in a reservoir 125 feet deep and still measure the depths closely enough in the model so as to represent one-half inch or three-fourths of an inch in the prototype.

Q. That is so the gages would reflect any change that would be as small as one-half or three-fourths of an inch in the full sized project?

A. Yes sir, in the full sized project.

Q. In the development of an integrating model, are gaging stations and records essential?

A. Absolutely.

Q. For what reasons?

A. In order to adjust the roughness of the model so as to satisfy the necessary conditions.

Q. Is that adjustment of roughness a matter of trying to reproduce a little Sandstone Falls or to adjust the friction so it will conform to the mathematical or hydraulic laws?

A. The latter is the case.

Q. State whether the principle of solving hydraulic problems by model testing is used in practical work?

2491 A. It is used very extensively in practical work; at the present time the U. S. Government maintains a great Laboratory at Vicksburg, Mississippi, where that work is done on a great scale.

Q. Can you state whether or not the use of model testing as a short cut for complicated mathematics increases with the size and complexity of the project?

A. Yes; on very large projects it is feasible to spend the necessary money to make large and accurate models.

Q. In your cross examination, with reference to the volume of Wave #10 at Kanawha Falls I was not quite clear when the reporter read your answer whether he gave the volume as 3,050 second foot day or 1,350 second foot day. Which is correct?

A. 1,350.

Q. You were asked to give a number of figures for the volume of certain of the waves mentioned or included rather in the 1930

wave tests. Will you state whether the volume of those waves were computed from the Government Exhibit #141, or Government Exhibit # 226 or #227; which one was it?

A. They were made from #141.

Q. The large hydrograph?

A. Yes, sir.

Q. Of individual gaging stations?

A. Yes; of individual gaging stations.

Q. You were also asked on your cross examination about a certain lockage you had observed at Marmet, in the course of these tests, and you spoke of preparing the lock as I understood it; what did you mean by that?

A. In case the boat approached from the downstream side of the lock it would be necessary to empty the lock before the boat could enter.

2492 Q. That would be true if the lock had been filled?

A. Yes; if previously filled.

By Mr. THOMPSON:

I understood him to say on his cross examination he didn't know if the lock was empty or not.

A. I might have looked in the record to see the previous lockage, whether upstream or downstream. I did not do that when you asked me the question.

By Mr. THOMPSON:

You don't know now, do you?

A. I can look it up now.

By Mr. THOMPSON:

Q. But you don't know at this time?

A. I have my notes of the lock master's record but I can't answer that without looking at the notes.

Q. When you said a minor oscillation might be caused by lockage, what is it about the lockage operation to which you refer?

A. It is the emptying of the lock through the conduits of the lock into the pool in which the fluctuation will occur.

Q. What effect, if any, would the filling of the lock at the lower end of the pool have as regards the possibilities of a minor oscillation?

A. The filling of the lock could have an effect also in producing an oscillation.

Q. Have you got at hand the exhibit about the 1930 wave tests?

By the COURT. How could that happen? You are transferring a boat from the London pool into the Marmet pool. How could the filling of that lock which must be filled from the London

2493 pool where the water comes into it from the upper pool,

how would the mere filling of that lock produce an oscillation in Marmet; it might if the lock were emptied?

By the WITNESS. What I had in mind was the filling of a lock at Marmet.

By the COURT. You are at London dam, passing a boat downstream——

By the WITNESS. That wouldn't have any effect, the filling of the Marmet lock would affect the Marmet pool.

Q. Professor Thomas, your attention was directed to Wave #4, I believe, on those wave tests?

A. Yes, sir.

Q. Will you state whether in your opinion that wave is typical of those wave tests?

A. In my opinion Wave #4 was not altogether typical.

Q. You were asked about the percentage of reduction in volume and amplitude of Wave #4 and Wave #10 of that test?

A. Yes.

Q. Will you state the reduction, percentage of reduction in volume and amplitude of some of the other waves on that chart, if there are any to which you would like to refer?

A. The reduction in volume from the Radford dam site to lock #2 Wave #5, has a reduction to 40%.

Q. Stated the other way is that a reduction of 60%?

A. Yes, a reduction of 60%.

By Mr. JACKSON:

A. In the case of Wave #8 the volume at Lock #2 was 51 percent of the volume at the Radford Dam Site.

2494 In the case of Wave 13A, the volume of the wave at Lock #2 was $16\frac{3}{10}$ percent of the volume at the Radford dam site.

In the case of Wave 13B the volume at Lock #2 was 15 percent of the volume at the Radford Dam site.

In the case of Wave 14A the volume at Lock #2 was $16\frac{1}{2}$ percent of the volume at the Radford dam site.

In the case of Wave 15, the volume at Lock #2 was 47 percent of the volume at the Radford dam site.

In the case of Wave 16, the volume at Lock #2 was 38 percent of the volume at the Radford dam site.

Q. Now will you please give the percentage of reduction in amplitude?

A. In the case of Wave #5 the amplitude at Lock #2 was 45% of the amplitude at the Radford dam site.

The amplitude of Wave 7 was $39\frac{1}{2}$ percent of the amplitude of that wave at the Radford dam site.

In the case of Wave #8 the amplitude at Lock #2 was 40% of the amplitude of that wave at the Radford dam site.

In the case of Wave 13A the amplitude of the wave at Lock #2 was 10½ percent of the amplitude at the Radford dam site.

In the case of wave 13B the amplitude at Lock #2 was 18½ percent of the amplitude at the Radford dam site.

In the case of wave 14A the amplitude at Lock #2 was 13 percent of the amplitude at the Radford dam site.

In the case of Wave 14B the amplitude at Lock #2 was 27 percent of the amplitude at the Radford dam site.

In the case of Wave 16, the amplitude at Lock #2, was 30 percent of its amplitude at the Radford dam site.

Q. In a comparison which you were asked to make between the 1930 waves upstream and those same waves at Kanawha Falls and other points downstream, were those comparisons based upon the wave as it was emitted from the Buck Power Plant or upon waves as they passed the Radford Dam site?

2495 A. They were based on the latter.

Q. You were also asked to make some comparison between the waves of 1930 wave test and the waye of the form and volume disclosed by exhibit 594. Do you recall that?

A. Yes.

Q. Was that comparison based upon the 1930 wave test as they passed the Radford dam site?

A. It was based on a study of those waves.

Q. What I am getting at is, in making the comparison, did you take those 1930 waves in the form they passed the Radford dam site or in the form when they were emitted from the Buck Plant upstream?

A. I took them in the form where they passed the dam site.

Q. What effect, if any, or what difference in the form of these waves, that is, the form of 1930 waves, as they passed the Radford dam site, and the form of the waves conforming to exhibit 594, as it was assumed to be discharged at the Radford power station, what difference in the form would there be in the discharge at the Radford Power Station or what difference would it have upon the percentage or reduction in amplitude or volume in second feet by the time these waves respectively reached Kanawha Falls?

A. The waves corresponding to the exhibit would have a greater reduction at the time they passed Kanawha Falls.

Q. Would the difference in the form of the two waves have something to do with that?

A. Yes, sir.

Q. Explain briefly why that is?

A. The greater length of the wave corresponding to Exhibit 594, that is, the fact that it occupies the greater portion of

2496 the day would tend to fill up the valley between successive waves.

Q. What is the comparison between the duration of the maximum peak of a wave-conforming to exhibit 594, and the duration of the peak of the waves of the 1930 wave test as they passed the Radford dam site, that is, which has the greater duration, referring to maximum peak?

A. The maximum peak in Exhibit 594, has a duration of one hour.

Q. How does that compare with the maximum peak of the waves of the 1930 wave test as they passed the Radford dam site?

A. That is less.

Q. Which is less?

A. One hour is less than these other peaks.

Q. You were examined at some length about the percentage of relationship between amplitudes and volumes of waves as they proceeded downstream. Does the mere relation between amplitudes and volumes of waves at the successive points travelled downstream give a true picture of the nature or extent of change in those waves or wave conditions in passing downstream?

A. No, I am of the opinion we cannot solve problems pertaining to wave head reduction or wave amplitude reduction by applying simply percentages based on other waves.

Q. Does the percentage of volume and time enter into that picture?

A. I should say yes.

Q. Can you explain or illustrate your answer more fully with respect to your view that percentage relationship of this character does not give a true picture?

A. I think I can explain that more clearly by making a sketch.

By Mr. JACKSON. I would like to have the sketch which the witness made with reference to his explanation of the principle of integrating model marked Defendant's Exhibit 597 before it is removed from the easel.

(Said sketch is here filed, marked Defendant's Exhibit 597.)

By Mr. JACKSON:

Q. Now go a head, Prof. Thomas, with your explanation?

2497 A. Sketch "A" represents a series of waves of comparatively small amplitude released at an upstream point such as Radford. For simplicity, I will assume that they are released at a time when the stream bed is practically dry. That is a simplified explanation.

Sketch "C" might represent the conditions when those waves have reached a downstream point such as, for example, Kanawha

Falls. The condition there is caused by overlapping of the crest and tails of the waves, as shown by the dotted line.

A. If there was no flow in the river, the base flows or mean flows would be the same in both cases. I will represent the mean flows by "M."

Now then I will sketch a similar sketch for waves of greater amplitude. These waves again are caused by overlapping the original waves and if there was no flow in the river, the mean flow would be the same, because of overlapping and the filling up of the base. It is readily possible for both amplitudes to be exactly the same at the lower point, although caused by waves of greater amplitude at the upper point, in which case the mean flow would be the same.

In the case of the lower wave, if we assume the original amplitude was 1,000, and the final amplitude was say 500, the percent reduction in amplitude would be 50 percent. Now if we take a higher initial wave and we assume an amplitude of say 3,000, and I am taking that figure simply for illustration, and the same amplitude occurs at the lower station, the percent reduction would be 500 over 3,000 or it would be reduced to 16 percent.

I make this illustration, not to represent any particular case, but just simply to bring out the general proposition that you cannot depend on simple percent reduction as to the case
2498 of two series of waves of unequal amplitude. It is important in this situation to understand that you cannot go on a simple percentage reduction basis. The shape of the wave is more important than amplitude, and it is readily possible that waves of greater amplitude at the upper station will have equal or even less amplitudes at the lower station.

Q. What are those broken lines on that sketch?

A. They represent the tails of the waves as they would be if the waves were individual waves.

Q. That is, the merging of the lower part of the wave?

A. Yes, sir; into a general base flow, the only difference of the two is seen to be in this case that the base flow is higher.

Q. Have you finished your explanation?

A. Yes, sir.

By Mr. JACKSON:

I will ask that the sketch which has just been prepared by the witness be filed as Defendant's Exhibit 598.

(Said sketch is here filed, marked Defendant's Exhibit 598.)

A. (Continuing.) There is another thing I would like to say——

By Mr. JACKSON:

Go ahead.

A. In determining the percent of reductions of waves it is important to take into consideration a great many things, among them whether the wave occurs on a rising or falling stage of the stream, whether the wave is one of a series or group of
2499 similar waves or whether adjacent waves are larger or smaller, whether there are minor wave summits between the main wave summit. All of those things enter into the question of what the reduction in amplitude and volume will be, and in the case of the 1930 wave series, we noted that there is an enormous variation in the percent reduction and volume of individual waves, and those percentages depending on a variety of conditions which were present in that series.

Q. Now you were asked to make a percentage comparison in reduction in amplitude and volume between this hypothetical wave emitted at Radford to conform with the Defendant's Exhibit 594, and certain of the 1930 waves as they passed the Radford dam site. Please state whether in your opinion if any percentage comparison were to be made at all, the percentage of comparison between reduction in the wave corresponding to Exhibit 594, in the matter of amplitude and volume, and any of the waves of the 1930 wave test, after reaching some point downstream such as Kanawha Falls should be made with those 1930 waves as they pass the Radford dam site or as they were emitted from the Buck Power Station.

A. It would be more proper to make a comparison with those waves as they were emitted from the power station.

Q. Please explain why?

A. Because as emitted from the power station they would more closely resemble the shape of the actual wave which would be emitted from the power station, and would not have the sharp triangular peak that they had attained when they reached Radford.

Q. Can you select some downstream gauging station which would be appropriate for such comparisons?

2500 A. In making such comparison I would say that the travel of the 1930 waves from Ivanhoe to Hinton could be compared approximately with the travel of the future Radford wave, from Radford to Kanawha Falls.

Q. Which would have the longer travel?

A. The latter, or from Radford to Kanawha Falls is 156 miles, while the distance from Ivanhoe to Hinton is 130 miles.

Q. What effect, is any, would that form of comparison have upon the answers which you gave on cross-examination where you used the Radford dam site as the point from which to measure reduction in the 1930 waves?

2501 A. The reductions in the waves from Radford to Kanawha Falls would be somewhat greater than from Ivanhoe to Hinton, because the distance is slightly longer.

Q. Can you give percentages in reduction of amplitude and volume from Ivanhoe to Hinton?

A. Yes, on some of these waves the reduction in volume, or the volume at Hinton expressed as percentage to the volume at Ivanhoe for Wave #5 is 48 percent, for Wave 8, it is 49½ percent, for wave 13A, it is 34 percent. For wave 13B it is 38 percent. For Wave 14A it is 33 percent.

Q. Are those all in volume?

A. Those were volumes.

The amplitude for wave 5, is 41½ percent, for wave 7, it is 44½ percent; for wave 10, it is 37½ percent; for wave 12 it is 48 percent; for wave 13A it is 10 percent; for wave 13B it is 11 percent; for wave 14A it is 10 percent. For wave 14B it is 34½ percent. For wave 15 it is 23½ percent. For wave 16 it is 14 percent.

Q. Will you give the reduction in amplitude for Wave #8?

A. For wave #8, it is 45 percent.

Q. Are these reductions or percents that you have given, are they the percentage in the original volume that remained at that point?

A. No, sir, they are the ratio of the final to the original.

Q. Will you look at wave 4 about which you were cross-examined, and tell me what was the duration of that wave at Lock #2, how many hours?

A. At Lock #2, the duration was very close to 24 hours.

Q. Please look at Exhibit 141 where the scale is larger?

A. No, I am looking at Wave #2.

Q. Please look at Exhibit 141 and give me the duration for wave 4 at Lock #2?

A. About 28 hours.

2502 Q. Was that Wave #4 followed by an overlapping wave?

A. Wave No. 5 followed it.

Q. Was that Wave #5 overlapping Wave #4 in the same sense as waves in the series you considered would form, conforming with Defendant's Exhibit 594?

A. Possibly, I should say they do not overlap so much.

Q. What I am getting at is the matter of comparison.

Were you comparing there for instance a 28-hour wave with a 24-hour wave, or were you asked to do that?

A. Yes, wave #4 is a 28-hour wave, which would necessarily have more volume than a 24-hour wave.

Q. And would it have any effect on percentage reduction?

A. It would give some reduction in volume, of course.

Q. That is, for wave #4?

A. Wave #4, I do not consider it a typical wave, it occurs on a descending stage and it is spread out in width.

Q. You were asked this morning to express an opinion with reference to the persistency in volume of waves of the form shown on defendant's Exhibit 594, and of certain waves corresponding to the characteristics shown on Plaintiff's Exhibit 226, do you have that?

A. I do not h've it here.

Q. In making your answer did you assume, or did you not, that the volume of the wave in each instance would be the same?

A. I had in mind that they would be the same.

Q. On your cross-examination you were asked with reference to the matter of any flow over the crest of dam on any of the navigation pools on the Kanawha. Please state whether flows over dams at navigation pools of that character do occur?

A. Yes, sir; they do occur, quite frequently.

Q. You were also asked questions with reference to the level of pools such as navigation pools on the Kanawha. Will you please state whether those pool levels are or are not subject to minor fluctuations?

2503 A. Yes, the pools are subject to minor fluctuation.

Q. Does that answer apply to present conditions of operation on the Kanawha?

A. Yes, sir.

Q. Under present conditions of operation, are these minor fluctuations both above and below normal pool level?

A. Yes, that means occasionally the water slops over or even frequently slops over the gates.

Q. Prof. Thomas, in your testimony with reference to the reduction of these waves passing down the river, did you give any consideration to such re-regulation, if any, as might occur in the Hawks Nest Pool?

A. No, I did not.

Q. In the course of your cross-examination with reference to the wave corresponding to defendant's Exhibit 594, treating that form as a daily series of waves, you were asked about the duration of one of those waves at Glen Lyn. Will you please state whether the duration of one of these waves at Glen Lyn would be equal to, greater or less than 24 hours?

A. I should say they probably would be equal to 24 hours, the tail of the wave would extend through a 24 hour period, by the time the wave reached Glen Lyn.

Q. Would there by any overlapping by the time it reached Glen Lyn?

A. There would probably be some.

Q. Would there be any overlapping at Hinton?

A. Yes, sir.

Q. Have you any opinion as to what the duration of overlapping would be at Hinton, and I mean just a single wave, the duration of one wave without giving any consideration to overlapping at Hinton, that is, would it be substantially more than 24 hours, or not?

A. You mean a single wave, not a series of waves, but one wave released by itself, with no wave preceding or following?

2504 Q. Yes.

A. Such a wave would have a duration of several days by the time it reached Hinton.

By Mr. JACKSON. Now, I would like to offer in evidence the two charts, marked "Defendant's Exhibits 597 and 598."

(Said charts are here filed, marked "Defendant's Exhibits 597 and 598.")

Re-cross examination by Mr. THOMPSON:

Q. Prof. Thomas, I only have a question or two to ask you. So far as you know, these waves 4 and 10 have never been criticised as not typical of the waves of the test made in 1930. Is that correct?

A. Nobody has criticised them to me.

Q. You never heard any objection to them?

A. I do not think I have discussed these waves, certainly with no one except a representative of the Power Company.

Q. Is it not a fact that on redirect examination you selected a number of very small waves which are not typical because of the various obscure facts as shown by the chart, and which have not previously been considered seriously?

A. I selected waves showing considerable reduction in volume, and I consider those waves should have just as much weight in making the decision as to the probable reduction as some of the larger waves. Because a wave is small is no sign its behaviour should not be given weight in making a study of wave reduction.

I think some of the larger waves have more serious distortion in them than some of these small ones. I selected those particularly to bring out the fact that simple percent relations cannot be applied in predicting lowering of waves. The problem is intricate and one requiring many things to be taken into consideration.

Q. Isn't it a fact that the smaller waves you have selected and testified to on your re-direct examination from Plaintiff's Exhibit 227, show less persistence and greater reduction than waves, 2, 4 and 10, from Radford to Lock #2?

A. Yes.

2505 Q. On this basis, would not the two Radford waves, coming from the Radford Project, and being larger, show a greater persistence than test waves, 2, 4, and 10?

A. No, I don't think that is probable.

Q. On the basis of ratio between these two groups, isn't that probable? I mean the Radford wave and the ratio between these smaller waves and larger waves, on your test waves of 1930?

A. As I explained in drawing this chart, I do not think you can discuss this question of reduction simply in terms of the size of waves; the shape is also important.

Q. It is a fact, is it not, that the larger waves on this 1930 test show a greater percent of persistency than the smaller waves?

A. I think in general that is so.

2506 DANIEL W. MEAD

Direct examination by Mr. JACKSON:

Q. State your full name and residence, for the record, Doctor?

A. Daniel W. Mead, Madison, Wisconsin.

Q. What is your occupation?

A. Engineer—Civil Engineer.

Q. What is your education?

A. A general common school education and a technical University education in civil engineering.

Q. Did you take a degree?

A. Yes, from Cornell University.

Q. When was that?

A. In June 1884.

Q. What was that degree?

A. Bachelor of Civil Engineering.

Q. Will you just state generally, Dr. Mead, what has been your experience, and then, after you have made the general statement, I will ask you to give some particular details.

A. Well, in general I might say that, after I left high school, I entered the machine shops and spent two years learning the machine trade and got some knowledge of machinery, and then I entered college and took the course in Civil Engineering at Cornell University and graduated in June, 1884; and I was for a very short time with the United States Geological Survey in Wisconsin; then City Engineer at Rockford, Illinois, and then went into contracting, and for the next twelve years, I was engaged most largely

in contracting, though I did some work in engineering designing at that time.

Q. Where were your headquarters?

A. In Rockford, Illinois. I left contracting and established an office in Chicago, as Consulting Engineer.

By Mr. THOMPSON:

Q. When?

A. About the latter part, I should say of 1899. I was in
2507 Chicago until 1904, and was asked to take a chair which was to be established, if I accepted it, in Hydraulic and Sanitary Engineering at the University of Wisconsin, the arrangement being that I should continue my practice and spend about half of my time during the college year in educational work, and half as I saw fit, in professional work. I served in that capacity as head of the Department of Hydraulic and Sanitary Engineering for 28 years, and resigned in 1932, but have continued lecturing on Contracts, Specifications and Engineering Relations, in one semester each year since I resigned. I have the position, if it can be called a position, of Professor Emeritus of Hydraulic and Sanitary Engineering.

By Mr. JACKSON:

Q. Doctor Mead, I have asked you to prepare a statement, not of all your professional activities, but of those along certain lines, and from that will you read into the record a partial list of the hydro-electrical projects that you have examined and reported on.

By Mr. THOMPSON. Can we have a copy?

By Mr. JACKSON. I haven't a copy—an extra copy now. We will give you one later.

A. The first plants mentioned here are those that I examined and made reports on, but not including construction. The next list is composed of plants I designed and constructed.

Q. Read that?

A. Yes. I want to say that reports were also made on the plants constructed but that I have not mentioned them.

The reports covered the Ox-Bow project, between Idaho and Oregon on the Snake River.

The Ocmulgee project, below Atlanta, Georgia.

The Big Sandy and Cheat River projects, of which there was a number—I don't know how many—in West Virgiina.

The Bull River project in British Columbia.

The Cornell and Knowlton projects and the Bad River project in Wisconsin.

The Manistee River Project at Lansing, and the Pere Marquette project in Michigan.

The Columbia River and Priest Rapids project in Washington.

The Spokane River project in Washington. I might say that I have reported on three or four plants on the Spokane River in Washington.

The Missouri River project in the State of South Dakota.

And there are various others that I cannot recall in detail. The following were designed and built. Shall I give the capacities?

By Mr. JACKSON:

Q. Yes, sir.

A. The next, I think, was the Prairie du Sac—it was 30,000 Kilowatts, on the Wisconsin River. These are not given in the order in which they were built.

The Kilbourn project in Wisconsin, on the Wisconsin River, 6500 Kilowatts. That was one of the early hydro-electric plants, built probably nearly 30 years ago. I think it was just 30 years ago.

High Falls on the Peshtigo River, 7500 Kilowatts.

Twin Falls, between Wisconsin and Michigan. That was 5,000 Kilowatts.

Johnson Falls, Wisconsin, 4,000 Kilowatts.

Brule River, between Wisconsin and Michigan; that was 5,000 Kilowatts.

Pine River, in Wisconsin, 4,000 Kilowatts.

Caldron Falls, on the Peshtigo River, Wisconsin, 7500 Kilowatts.

Sandstone Rapids, on the Peshtigo River, Wisconsin, 4,000 Kilowatts.

Alpena, Michigan; a small plant of 1200 Kilowatts.

Sturgeon River, Michigan, which was a small plant on a small stream—an automatic plant—1,000 Kilowatts.

And I have listed here Rockford, Illinois. I was City Engineer—but this was not for the City, but the Water Power Company there, which built their own plant, an early plant, and the system is the Rockford General Electric or the Rockford Edison Company, I believe, it was called.

Sterling, Illinois, was another old fashioned vertical turbine plant.

By Mr. JACKSON:

Q. Were any of these hydro-electrical plants, reservoir plants?

A. They were all reservoir plants, to an extent. Four I mentioned were built, one above the other on the Peshtigo River. The highest up was Caldron Falls; the next was High Falls, and Johnson—Falls and the Sandstone Rapids, and then two were

built—rebuilt lower down stream near Potato Rapids, and one near the mouth of the Peshtigo River.

I reconstructed various plants mentioned here—at Hatfield, on the Black River; Black River Falls and Peshtigo, Wisconsin; Ingalls, Michigan; and one on the Elwha River of the Olympic peninsula in Washington.

By Mr. JACKSON:

Q. State a little what subjects you lectured on, more in detail, in the University of Wisconsin?

A. My lectures were largely on what we call professional subjects; that is, the application of professional knowledge to the construction of various kinds of work. Among those were Water Power; Public Water Supply; Irrigation; Drainage; Hydraulic Machinery; Hydrology; Hydraulic Design; Contracts; Specifications and Engineering Relations.

Hydrology was a subject I introduced. I don't think it was ever taught before, but I insisted upon introducing it at the University of Wisconsin. It is now, I think, quite generally taught in all of the Universities.

By Mr. JACKSON:

Q. Have you had any experience in connection with the design and construction of dams?

A. Yes.

Q. Give a few instances of that?

A. Well, it is hard to remember back 52 years. I have noted them here [indicating papers]. As I recall them, I have noted them.

I mention here, among others, the Danville, Illinois, plant; the Batavia, Illinois, project; and Rockford, Illinois; High Falls; also Kilbourn—it is written here as Hilbourn, but that is a mistake—the "H" should be a "K." Prairie du Sac, Wisconsin. Iron Mountain and Alpena, Michigan; and on the Elwha River, in the State of Washington. There I put a foundation under a dam 100 feet high. The river ran under it and I had to seal the bottom and also reconstruct the plant.

Well, that was continued between 1904 to 1912. There are others mentioned later on. I think this is more or less of a——

By Mr. JACKSON:

Q. A chronological statement?

A. Yes, sir.

Q. Did you have any or have you had any experience in connection with flood control?

A. Yes, sir. I was Consulting Engineer throughout the construction of the Miami Conservancy District work and was acting

Chief Engineer for the first six months and organized the work and got it under way.

I made plans in Oklahoma City for flood protection of the City. Then on occasions, I was at Waterloo, Iowa, advising them as to the protection of their City from excessive floods.

By Mr. JACKSON:

Q. Now, Doctor Mead, I want to ask you to select some limited instances of your experience having some relation to the testimony and you have prepared this sheet. [Indicating.] I suggest it would be perhaps simpler if you read into the record such of these experiences as you have noted, beginning at the bottom of page 2, with the 1914 reference?

A. In 1914, I was a member of the Engineering Board for Flood control on the Huai River, in China, for the American Red Cross and the Chinese Republic. This work involved an expenditure of $43,000,000, but the World War broke out in Europe and it was not done.

In 1915, I was Consulting Engineer for the Miami Conservancy District, and Acting Chief Engineer for six months, during the sickness of the Chief Engineer. The total expenditure was $30,000,000; slightly above that, I believe.

In 1917, I reported on the dam and power plant in Austin, Texas, for the City of Austin; the Calaveras Spillway, San Francisco, California. I also reported to the Chief of Engineers of the United States on the foundations of the Muscle Shoals dam, called the Wilson dam.

In 1918 and 1919, I was consulting Engineer for the Peninsular Power Company, for the design and construction of hydro-electric plant on the Brule River, near Florence, Wisconsin.

For the City of Black River Falls, Wisconsin, on re-construction and design of hydroelectric plant.

In 1920 and 1921, I was consulting engineer for the Wisconsin Public Utility Company, Milwaukee, Wisconsin; the Wisconsin Railway, Light and Power Company, of Milwaukee, Wisconsin; the Wisconsin Securities Company, Milwaukee, Wisconsin; the Peninsular Power Company, Madison, Wisconsin, in the building of a hydroelectric plant that year, started on the Pine River South of Florence, Wisconsin.

Also consulting Engineer for the Public Service Company of Northern, Illinois, water power work.

For the Oconto Service Company, Peshtigo, Wisconsin, water power.

The State of South Dakota—reported on the feasibility of the development of hydroelectric power from the Missouri River. Reports published in April, 1920.

Also consulting engineer for the Northern Peshtigo Pulp and Paper Company for a hydrcelectric plant at Caldron Falls, Wisconsin—although this company did not build the plant which was finally built by another company.

In 1922, the design and construction of a hydro-electric plant on the Peshtigo River at Johnson Falls.

In 1922, continuing with water power, with the Oconto Service Company, Peshtigo, Wisconsin, began the design and supervision of power station for the Madison Gas and Electric Company of Madison, Wisconsin, and put in several units, I think 5, 10 or 15 thousand Kilowatts, as I remember, turbo generating plants for that company at Madison.

By Mr. JACKSON:

Q. I suggest that you turn to page 5 of the statement, and just simply state some of your more recent experiences, beginning with 1926 or 1927; whatever it is?

A. Do you want all of this stuff read [indicating paper]?

Q. Those that deal with your most recent experiences?

A. Well, in 1926 and 1927, I made investigation and report on the proposed hydroelectric developments on the Menominee River and the White Rapids and Chalk Rapids, for Halsey, Stuart and Company of Chicago and the First Wisconsin Trust Company.

I was consulting engineer for the Cheat Haven plant of the West Virginia Power and Transmission Company, with 75,000 horse power.

Consulting Engineer, Sacramento Municipal Utility District, California, as to new water supply and power development on the South fork of the American River.

Also consulting engineer for the Washington Water Power Company, Spokane, Washington, dam for Lake Chelan hydroelectric development.

Investigation and report on hydroelectric development at Wisconsin Rapids, for the First Wisconsin Company, Milwaukee.

That was a hydro development that was very large—I do not remember the capacity. That was a 400 foot head and a pretty heavy flow. I am referring now to the project of the Washington Water Power Company, Spokane, Washington, for a dam for Lake Chelan.

Then I made an investigation and report on the hydroelectric development at Wisconsin Rapids, to which I have alluded, for the First Wisconsin Company, which is a Bank.

In 1928 and to 1931, I was a member of the Colorado River Board for the United States Government. I was appointed—I do not know when it was; I guess the records will show that. I examined the Imperial Valley and various irrigation works on

the Lower Colorado Canyon and Colorado River, and these included the Boulder Canyon and the Black Canyon project in 1928, and we increased the estimate at that time from $125,000,000 to $165,000,000; that increase was not that much—by $40,000,000 to $165,000,000.

Reports and plans for the flood protection of Oklahoma River—I mentioned that—about a $10,000,000 proposition.

By Mr. JACKSON:

Q. Turn to 1932?

A. In 1932, I was still a Member of the Colorado River Board, and we approved plans for the Hoover Dam in November, 1932, at which time the Board finished its work.

I think it was in 1933 that I reported to the Illinois Central Railway in connection with the Bonnet Carre Spillway operation before the Federal Commission at New Orleans.

I think the same year, I reported on the hydroelectric development for the City of Spokane, Washington.

By Mr. JACKSON:

Q. I will ask you to omit some of these things, and I want to ask you whether or not you had anything to do with any plants on New River, in Virginia or West Virginia, in 1931?

A. Yes; through the New York office of Daniel W. Mead and F. W. Scheidenhelm, various investigations were made for plants on New River, in Virginia and in West Virginia.

Q. Have you had any connection with the Special Board for the Tennessee Valley Authority?

A. I am on the Board now, as consulting engineer about maximum floods in the Tennessee Valley; also I am Chairman of the Board of Review of the Sanitary District of Chicago, planning the expenditure of $56,000,000 for sewerage disposal.

Q. Have you published any scientific and technical books or writings?

A. Yes.

Q. Will you read a list of such books—not the articles that you have written.

A. I have a list here somewhere. I might explain that when I went to the University of Wisconsin, there were no available text books, and I published, before I went to Madison, certain notes on hydrology, which I think is the first publication on that subject in the United States; and when I took up the matter of water power, I was writing a book on that subject. There was nothing that covered it adequately.

Q. What book was that?

A. Water Power Engineering, published, I think about 1908, first, and revamped in different forms later on.

Another book was Contracts, Specifications, and Engineering Relations, published in 1916.

A book entitled Dam and Water Power Development at Austin, Texas, in 1917.

A larger and more complete work on Hydrology, published in 1919.

And a book, including my report on the feasibility of the Development of hydroelectric power on the Missouri River in South Dakota, published in 1920.

Also two volumes on Hydraulic Design, Estimate of Water Supply and Water Power of a River and the Design of a Hydroelectric plant, published in 1930. In 1930–1933, there was published my book on Hydraulic Machinery.

By Mr. JACKSON:

Q. I show you papers that you handed to me, which contains a list of the papers you have written, in addition to these books. Is that correct. [Papers are handed to the witness.]

A. So far as I can make out, yes, sir; that seems to be correct.

Q. I will ask you to hand that list to the shorthand reporter and have them listed in the record.

A. All right.

By Mr. JACKSON. Is that agreeable to you gentlemen? [Addressing opposite counsel.]

By Mr. THOMPSON. Yes, sir.

By Mr. JACKSON. I will ask that they be included in the record without having the witness read them.

SCIENTIFIC AND TECHNICAL WRITINGS OF DANIEL W. MEAD—1932

BOOKS PUBLISHED

Notes on Hydrology—Published privately—1904, pp. 202+XI.

Water Power Engineering—McGraw-Hill Book Company. 1908–1915, pp. 843+XVII.

Contracts, Specifications, and Engineering Relations—McGraw-Hill Book Company 1916. pp. 525+XI.

Dam and Water Power Development at Austin, Texas, City of Austin, 1917, pp. 205 VIII.

Hydrology—McGraw-Hill Book Co. 1919, pp. 647+XI.

Feasibility of the Development of Hydro Electric Power on the Missouri River in South Dakota, State of South Dakota, 1920, 4 vo. pp. 118+VIII.

Hydraulic Design, 2 vols. Madison 1930—Vol. 1. Estimate of Water Supply and Water Power of a River. Vol. 2. The design of a Hydroelectric Plant. Hydraulic Machinery. 1933.

PAPERS

Sources of Water Supply—Report of the 4th Annual Meeting of the Illinois Society of Engineers and Surveyors, 1889, pp. 38–39.

The Qualities of Water for Domestic Supply and Use—Report of the 7th Annual Meeting of the Illinois Society of Engineers and Surveyors, 1892, pp. 24–37.

The Geology of Wisconsin in Water Supplies—Report of the American Water Works Association—1893, pp. 63–74.

Notes on the Hydro Geology of Illinois in Relation to its Water Supplies. Report of the 8th Annual Meeting of the Illinois Society of Engineers and Surveyors, 1893, pp. 48–68.

The Hydro Geology of the Upper Mississippi Valley—Journal of the Association of Engineering Societies, Vol. 13, 1894, pp. 329–396.

Pure Water vs. Purified Water for the Public Water Supplies—Papers and Reports of the American Public Health Association; Vol. 20, 1895, pp. 49–52.

Locating a Public Water Supply—The Engineering Magazine, Vol. 10, 1895, pp. 876–882.

DeKalb Electrical Pumping Plant—Journal of the Association of Engineering Societies, Vol. 15, 1895, pp. 83–101.

The Hydraulic Ram—11th Annual Report of the Illinois Society of Engineers and Surveyors, pp. 50–60, 1896.

Mechanics of Suction and Suction Pipes—Journal Western Society of Engineers, Vol. 4, 1899, pp. 12–34.

Notes on the Commercial Transformation of Energy—14th Annual Report of the Illinois Society of Engineers and Surveyors, 1899, pp. 38–75.

Notes on Steam Engine Indicator—15th Annual Report of the Illinois Society of Engineers and Surveyors, 1900, pp. 44–59.

New Plant for Increasing the Water Supply at Rockford, Illinois. Proceedings of the 13th Annual Meeting of the Iowa Engineering Society, 1901.

Appraisal of the Value of Public Utilities—American Water Works Association 1902, pp. 9.

Some Small Water Works Installations—proc. 22d. Annual Meeting American Water Works Association, 1902, pp. 183–212.

A Gas Driven Direct Pressure Pumping Plant—Journal of the Western Society of Engineers, Vol. 7, 1902, pp. 20–35.

Recent Improvements in the Plant of the Danville Water Company, Journal Western Society of Engineers, Vol. 10, 1905, pp. 272–289.

Technical Instruction in Hydraulic Engineering—Proc. of the Society for the Promotion of Engineering Education, Vol. 16, 1908, pp. 174–199.

Hydraulic Engineering at the University of Wisconsin—Journal of the Western Society of Engineers. Vol. 13, 1908, pp. 1–34.

The Relations of Experimental Results to the Theory of the Tangential Wheel. Bulletin of the University of Wisconsin, No. 337, 1909, pp. 1–104.

The Flow of Streams and the Factors that Control it.[8] Bulletin of the University of Wisconsin, No. 425, 1911, pp. 1–192.

The Runaway Speed of Water Wheels—Proc. of the American Institute of Electrical Engineers, Vol. 31, 1912, pp. 1937–58.

The Cause of Floods and Factors that Influence Their Intensity[9]—Journal Western Society of Engineers, 1913, Vol. 18, pp. 239–282.

The Present Status of the Water Powers of Wisconsin—Read before the Engineering Society of Milwaukee, January 1914, Published privately, pp. 1–39.

Hydraulic Engineering Education—Bulletin of the Society for the Promotion of Engineering Education, Vol. 4, 1914, pp. 185–198.

Latent Water Powers of Wisconsin—7th Annual Convention of Wisconsin Electrical Association, Milwaukee, 1915, pp. 8.

Four Thousand Years of Practical Engineering in China—The Wisconsin Engineer, January, 1915, pp. 1–29.

The Influence of Surface and Subterranean Waters on the Flow of Streams—13th International Congress of Navigation, London, 1923.

The Economics of Hydro Electric Development—American Society of Civil Engineers, Atlanta, Georgia, 1924. Transactions, Vol. 88, p. 158, 1925.

An Analysis of the Proposed Plans for Flood Protection of the Lower Mississippi Valley. Journal Western Society of Engineers, Vol. 33, p. 297, 1925.

Floods and Flood Protection in the Lower Mississippi Valley. Bulletin of the Associated State Engineering Societies, July, 1928.

The Colorado River and Its Proposed Development. The Boulder Dam Project. Journal Western Society of Engineers, Vol. 34, July 1929.

The Boulder Canyon Project. Bulletin Association Engineers Societies, July 1929.

The Colorado River, The Imperial Valley, and the Boulder Canyon Project. Wisconsin Engineer, Vol. 34, October–November, 1929.

The Rockford Water Supply, Journal American Water Works Association, August, 1933.

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[8] Awarded the Fuertes gold medal for original research by the Engineering Department of Cornell University.

[9] Awarded the Chanute medal for best paper on civil engineering presented before the Society for the year 1913.

Water Works Development of the St. Lawrence River, Proc. American Society of Civil Engineers, August, 1933, pp. 965–82.

By Mr. JACKSON:

Q. Are you a member of any professional or technical Societies?

A. I have quite a list of it. I will read them.

Q. Can you hand the list to the shorthand reporter, if that is agreeable.

By Mr. THOMPSON: That is all right.

By the COURT. What are some of them?

A. The American Institute of Consulting Engineers, The American Society of Civil Engineers, American Society of Mechanical Engineers, Western Society of Engineers, American Water Works Association, New England Water Works Association, Wisconsin Society of Engineers, Illinois Society of Engineers, International Association of Navigation Congress, Society for Promotion of Engineering Education, American Association for Advancement of Science, American Academy of Political Science, American Political Science Association, American Forestry Association, American Meteorological Society, American Institute of Electrical Engineers, American Public Health Association.

A. (Continuing.) And there are others that I cannot now recall.

By Mr. JACKSON:

Q. Do you hold any office in the American Society of Civil Engineers?

A. Yes.

Q. What is it?

A. I am the 1936 President; the President for the year 1936.

Q. Doctor Mead, do you have any business relationship with the defendant here, the Appalachian Electric Power Company?

A. Yes; both directly and indirectly. I have been associated with Colonel Scheidenhelm, since, as near as I can remember, since 1912, in New York, under the firm name of Mead—Daniel W. Mead and F. W. Scheidenhelm, Consulating Engineers, and I think, for about 11 years, my office has done considerable work for the Appalachian Electric Power Company.

Q. Have you been connected with the work or not?

A. Yes, sir—Yes and no—not intimately acquainted with it, because Colonel Scheidenhelm gives his special attention to it, and I come in occasionally, when he asks me to. My work is done largely in the West.

Q. Can you state what part of the work done by your firm for the Appalachian Electric Power Company, you are most familiar with?

A. I know more about the Radford project, in a general way, than any of the others, although as I said above, I did examine two sites on the lower New River in West Virginia.

Q. What were they?

A. One was just above Hinton, about one mile, and the other about 9 miles above, called Bull Falls.

Q. When did you make that examination?

A. I could not tell you.

Q. Was it sometime ago?

A. Yes, sir; some years ago. I appeared at that time before the West Virginia Rate Commission—is—I don't know the name, but they had jurisdiction over the granting of the license.

Q. I believe it is the West Virginia Public Service Commission?

A. Possibly so; I don't know the names.

Q. At the time that you made the examination near Hinton, was the possibility of constructing some project there under consideration?

A. Yes, sir.

Q. Did it have a name, do you know?

A. It had a name, but I have so many things in my mind that I cannot remember it. It was a dam above Hinton and Bull Falls dam, the latter being a very high dam and the other a re-regulating dam, as I recall it.

Q. Well, you say there were two dams—a dam and a re-regulating dam?

A. Yes, sir; they were both dams, and the reregulating was more particularly the function of the smaller dam.

Q. Would that mean one high dam and one——

A. (Interrupting.) Yes, and one lower down and about a mile above Hinton.

Q. It was about a mile above Hinton?

A. That was the smaller reregulating dam and the other was about nine miles, I think, at Bulls Falls. I may be off as to the miles.

Q. You said you were more familiar with the Radford project. Are you acquainted with the details of that project?

A. No, I am more acquainted with the dam site and the reservoir. I have been there several times and examined the question of the location and other questions connected with the fundamental elements of the design.

Q. What is the extent of your acquaintance with New River?

A. Well, I should say it was limited to that examination that was made above Hinton; I remember that when I went on the Bulls Falls site and went up five or six miles further, and back through Indian Creek and went across the river again at some place—I do not remember the name, but I remember the poor

supper we had there, and finally got to Radford—or the dam site at Radford.

Q. Were you ever at the Narrows?

A. We passed the Narrows, I think, somewhere; I think it was near that that we had the memorable supper.

Q. How often, if ever, have you visited the Radford dam site?

A. I cannot remember that; I should say three or four times; possibly more; but I am quite sure three or four times and I think at least three and I think four or more.

Q. Do you have any acquaintance with Kanawha River?

A. I have known in a general way of the Kanawha River for many years. I had occasion to lecture once for a good many years on the question of rivers and canals for navigation, and at that time, I knew pretty thoroughly about the lock and dam system on the Great Kanawha and the Ohio, and I visited some of the dams on the Ohio and I visited the Kanawha River, the first time at Point Pleasant, and went on to Charleston and stopped and examined some of the dams and locks, and I remember taking various pictures there.

By Mr. THOMPSON:

Q. How many years ago was that?

A. I should say that my first actual contact with the river must have been 25 years ago—possibly more; and of course these locks have been replaced or are now being replaced, and I have not seen the river since I was there—yes, I was at Charleston when I made the investigation of the Hinton site, but I have not seen the river since the new dams and the power plants were put in at two places; I understand there are three locks or dams and power plants, that are replacing seven original dams on the river."

By Mr. JACKSON:

Q. Dr. Mead, what is the proposed storage capacity of the Radford project?

A. 100,000 acre-feet.

Q. What would be the equalized flow out of the Radford project if during the year of the lowest stream flow of record the storage capacity were utilized to bring about the largest uniform flow throughout that period?

A. It is about 1,200 second-feet—a little bit less than that, I think. In round numbers that is close enough for all practical purposes.

Q. Are you familiar with the methods of operating storage for a power development, such as the Radford project?

A. I have had to become pretty familiar with hydraulic plants, including reservoirs, which are quite often an important matter in connection with them.

Q. Over how many years has your experience in that regard extended?

A. Oh, I should say 30 years, at least.

Q. How could the operator of such a storage reservoir operate the project if an equalized flow of a minimum amount of
2508 1,200 second-feet was to be maintained?

A. The equalized flow, perhaps, ought to be explained. It is an equalized flow in a sense, but it is not used in a wholly equalized manner. That, when I say 1,200 second-feet, would mean that that was about the average rate at which it would have to be used. It might have to be used four or five times that amount for a certain length of time and even less than that amount a part of the time, but the average flow for 24 hours would have to be not more than that. In the operation of a plant, any plant, for the best uses of a stream, taking other parts of the year leading up to the dry season we would see that we did not exceed, say, the average weekly flow of the stream, and try and leave the reservoir full on the approach of the extreme dry weather. Occasionally before that time we might get less than what we considered the minimum, perhaps for a day. That might take a little water from the reservoir, which would be replaced the next. When the dry weather really came on, we would augment the natural flow of the stream to bring it up on a 24-hour or a seven-day period, or whatever the unit might be used, keeping always preferably within, say 1,200 second-feet, because it is a wise provision to take care of something that might be worse than we have ever known. So that it would be very poor policy to draw on your reserve supply except when absolutely necessary, for two reasons: Power is necessarily made up of weight and head. The weight of the water we are using and the head of the water. Where you draw a reservoir down, you reduce not only the quantity of water held but the head. With the head, you reduce the capacity of your plant, and good judgment always means that a reservoir of the full capacity possible be reserved as long as possible.

Q. Would that effect result on the average to stretch the storage out over the low-water season?

A. That is what we determine when we say 1,200 feet could be carried by use of 100,000 acre-feet of storage through the maximum dry period which we experienced, which would include the
2509 years 1925 and 1930. Both were low years, and I do not know which was the less.

Q. When you said 1,200 feet a moment ago, you meant 1,200 cubic feet?

A. 1,200 cubic feet per second used irregularly through the time, as long as the average for the day, or week, or month, did not exceed that amount. That is the measure that we have

established, and it must not be exceeded for long intervals, the object being, of course, to have, at the end of the first month and the beginning of the second month, enough to carry through the balance of the dry season. At the end of the third month, you would have enough to carry through the balance of the dry season.

Q. Would it be feasible for the operator of the Radford project to utilize the storage, or to draw the storage down, in advance of the low-water season?

A. I suppose he might do it if he was not interested in getting the best results. It would be a very foolish proposition.

Q. Dr. Mead, are you familiar with the United States Geological Survey Stream Flow Estimates on New River for 1930?

A. Yes. I examined them.

Q. Have you examined the records for the gaging stations above Radford?

A. Yes, I saw that. I think I saw one above and one below. The one above I gave particular attention to.

Q. Doctor, I hand you a water supply table, duplicate of which has been marked "Government Exhibit No. 81," and I direct your attention to pages 62 and 63 and ask you what table is shown there, and whether you have studied the table?

By Mr. THOMPSON:

Q. Will you kindly tell what water supply table that is?

A. 698. I have looked these over, and one of them shows the approximate flow per day, September 26, 1929, to September 30, 1930. That is at Allisonia. The other is the same time—no: It starts October 1, 1929, and goes to September 30, 1930, at Eggleston. Eggleston is below, as I recall, and Allisonia is above.

2510 By Mr. JACKSON:

Q. Dr. Mead, from your examination of the table showing estimates of daily discharge for New River at Allisonia, Virginia, for the twelve months ending September 30, 1930, as shown in "Government Exhibit No. 81," when, in your opinion, would the utilization of the Radford storage have been begun if the Radford project had been in operation in 1930?

A. With a full reservoir, there would be some very slight draft in June. I am supposing if intelligently used, there would have been some slight draft in June, when the flow went down apparently below 1200 second feet. About June 22 it ran down to 1,070, which is a little below probable flow at the Radford dam, as this flow is only about twenty miles up-stream and about ten percent under the probable flow at Radford. Then it goes down for the next day, and up the next to 1,270, and then it remains

below 1,000 for about two months, when the dry weather flow would be augmented by the reservoir capacity and probably above the plant, and bring it up to not exceeding 1,200 second-feet. That is on an average. It might exceed it a day and be less the next day, but the average should be kept under 1,200 second-feet.

By Mr. THOMPSON:

Q. I don't know whether I understand it right; That is for two months it was below a thousand second feet, and at that time you were figuring on drawing from the reservoir?

A. Yes.

Q. To bring it up to 1200?

A. Yes.

By Mr. JACKSON. Not more than 1200.

Q. Under that method of operation, would the storage be exhausted at any time prior to the end of the low water season?

A. Not unless—I don't know that it ever gets so low so you can't find some time it might go lower, and, therefore, you should cut under 1200 feet. It may occur.

Q. You said in the first part of your answer, assuming, at the commencement of the low water season, the reservoir was full, please state whether, in your opinion, under proper
2511 operation the Radford reservoir would have been full at the commencement of the low water season early in June?

A. Under proper operation it certainly should have been filled and practically full at the time of the low water season. We have had quite a number of years of it and we know practically what we strike.

Q. Would you consider it a reasonable or an unreasonable method of operation if, under conditions disclosed in 1930, the utilizable storage of the reservoir had been depleted, or exhausted, prior to June 22nd, or 23rd, 1930?

A. I should consider it an inexcusable blunder.

Q. Are you familiar with the load requirements of the system of the Appalachian Electric Power Company?

A. No, I don't know anything about it except in the way, as I have stated, of loadcurves in pretty near all the country in the main plants. I do not recall that particular load curve. I may have seen it and presume I have.

Q. Does that fact in any way affect the opinion which you have expressed with regard to the method of operation which would have drawn down or exhausted the Radford reservoir prior to June 22, 1930?

A. None whatever.

By the COURT:

What was the date, during 1930, when the stream flow was returned to as much as 1,200 feet?

A. It did for four days in August, but it went down again. There was evidently rainfall somewhere. Well, there were four days in August, and then it kept under 1,200 feet up to the 17th of November, when it was up for a few days, then it was down and up, and a few days were below in December, and one day it was below in January, no two days below in January, but in general it was getting back up about 1,200, some days as high as 9,000. It varies as those rivers always do. By the 1st of December or 2nd of December it got up to 1,230 although there were two or three days when it was below 1,200 later on.

2512 Q. That is according to the gaging station upstream from the dam site?

A. Yes, sir; which really should be increased about 10% I think for the Radford dam site.

Q. You stated earlier in your testimony, Dr. Mead, that this uniform flow which could be produced by the 100,000 acre-feet of Radford storage, was expected to be approximately 1,200 second-feet?

A. Yes, sir.

Q. Did that estimate of 1,200 second-feet take into consideration the low water season or experience of 1930?

A. It was based on the two low water periods of 1925 and 1930.

Q. Is that sort of an estimate based on the worst years or the best years?

A. Those were the two worst years, that is what we always base reservoir studies on.

Q. Are you familiar with the Bluestone reservoir project as it is described in the report of the Army Engineers, which is in evidence here as Government Exhibit #145?

A. In a very general way, yes, sir.

Q. Do you know what height of dam is contemplated by that project?

A. My recollection is about 150 feet for the combined project I take it for flood protection and power.

Q. Do you know what the storage for flood control is, the amount reserved for flood control?

A. Of course all I know and all anyone knows is what is estimated in that report, because there is no such thing, 150 feet, and the upper 30 feet is supposed to be reserved for flood control, and has a capacity as I recall it of about 236,000 acre feet. I wouldn't be positive without looking up the figures. I think I noted them somewhere. (Referred to file.) Well I have it 235,000

acre-feet and the power storage I figured would have a maximum head of about 120 feet and about 286,000 acre-feet total
2513 capacity, including a certain amount that was to be reserved for freshets, but which I take it was also to be used for power.

Q. Did you mean 286,000 or 268,000?

A. I gave two figures.

Q. The last you gave was 286,000 reserved for power and I thought you had maybe misread your note?

A. It was 235,300 acre-feet, which allowed 5 feet above containing 32,700 acre-feet for freshets, and the two together—I take it freshet water was to be reserved and saved, as would be the intelligent thing to do—the two together would be 268,000. I think there is a slight indefiniteness in that report. I could not check one or two figures. One gave more than the other. This was stated directly 268,000 I recall in the report.

Q. Do you know whether part of this reservoir is devoted to power?

A. This 268,000 I understood was to be devoted to power purposes.

Q. Is that what we sometimes refer to as utilizable storage for power purposes?

A. Yes, sir.

Q. Please state whether in your opinion the operation of the Radford project would have any adverse effect upon the Bluestone project?

A. I don't see how it could have any adverse effect under any reasonable intelligent use.

Q. Do you think the Radford project would have any effect, adverse or favorable, upon the Bluestone project?

A. I think it would be entirely favorable in general. It really consists of 100,000 acre-feet additional capacity for Bluestone.

Q. Are you referring to storage now?

A. Yes, sir.

Q. Will you explain a little more fully the reason for your opinion as to the fact the effect would be beneficial?

A. Well it is just the ordinary principle we have on
2514 every reservoir where we are reserving water for storage purposes. We frequently have one dam above the other and it is the common attempt to utilize the storage so it will be of the greatest benefit to all concerned, but which cannot quite be accomplished in that way when the plants are in the hands of different interests, but universally there is a benefit from the upstream storage of water; it is simply holding back the floods that would pass off at a time they cannot be used, and putting them into the low spots where they can be used.

Q. How would that affect the possible power production at Bluestone?

A. It increases it, and as a rule that is what we are aiming at in these reservoir systems.

Q. What, if any, effect would the construction and operation of the Radford project have upon the Bluestone project from the standpoint of silting?

A. Without the Radford project the silt would be carried down into the Bluestone, and with it nothing but the finest material would ever reach the Bluestone or the river below. The up-river dams have a great advantage in that way, which sometimes are very serious, but I don't regard it as serious here as in the Boulder Canyon project. Unless we get some up-river projects we won't have any project there in 200 years. We will have thirty million acre feet of silt instead of thirty million acre feet of water.

Q. As I understand you—— [interrupted].

A. The Radford plant would keep the silt out of the Bluestone you call it.

Q. That is the silt would stop in the Radford reservoir?

A. Yes, everything except the very finest silt which in some cases, I don't know if in this river or not, but in most rivers certain silt will remain in suspension as long as any motion at all persists and sometimes after motion is stopped, but that is of no moment, because it will go right on down to sea eventually.

2515 Q. That is it would pass through the Bluestone?

A. This very fine stuff remains in suspension for days. Stuff like that would simply go down until it gets into the salt water. It doesn't amount to anything in volume.

Q. Going back a moment to your testimony that in your opinion the construction and operation of the Radford project would have a beneficial effect upon the production of power at Bluestone, will you explain how that additional 100,000 acre feet of storage at Radford would be used by the operator of Bluestone to benefit the Bluestone Reservoir?

A. Well it would replace an equal amount of water that might be used in power or it would increase the power output that could be obtained from the Bluestone project if more power was desired, without additional lowering of the Bluestone reservoir. That is, it would take the place of some used or it could add to the amount used.

Q. Am I right in understanding that would either mean more power would be produced at Bluestone or that the Bluestone reservoir would be maintained——[interrupted].

A. It would mean more power or more head.

Q. Are you familiar with the subject of fluctuating discharges from water power stations?

A. I have seen several.

2516 By Mr. JACKSON:

Q. Dr. Mead, at the adjournment Friday I had just asked whether you are familiar with the subject of fluctuating discharge from water power systems?

A. I am.

Q. For what period of time have you been familiar with that subject?

A. Well, I should say 50 years.

Q. What, in your opinion, would be the effect of the Bluestone reservoir, about which you testified Friday, upon varying discharge of power tides which might be produced in the operation of the Radford power station?

A. In general, the effect would be an equalizing effect.

By Mr. JACKSON:

Q. Will you state somewhat more in detail what, in your opinion, would happen to any power tides produced by the operation of the Radford station when those power tides reached the Bluestone reservoir?

A. In general, the tide would spread out over the reservoir and raise the water in the reservoir in proportion to the quantity of water in the tide.

Q. State whether or not, in your opinion, the power tide would pass through the Bluestone reservoir as a tide?

A. Not without change in form and quantity. If the reservoir was full, the water in the tide above the quantity necessary to fill the reservoir would naturally overflow and pass on down the river but have a different distribution in the quantity and in the distribution of the tide itself. If the reservoir were not full, it would simply spread out and add to the head of the reservoir.

Q. When you say if the reservoir was not full, which reservoir do you refer to?

A. I was speaking of the Bluestone reservoir.

Q. If the Bluestone reservoir were not full, what would control the nature of the discharge below Bluestone—the tides from Radford, or the method of operation of Bluestone?

2517 A. The operation of the gates or plants which, I understand, are installed in connection with the Bluestone dam.

Q. Under the circumstances last described, would the Radford power tide appear at all in the stream below Bluestone—that is when the Bluestone reservoir was not full?

A. Not as a wave—not as a tide. The water would, of course, continue to go down-stream unless it is conserved and held in the reservoir.

Q. Would any power tides from the Radford reservoir, under such circumstances, be recognizable in the stream below the Bluestone reservoir?

A. No, not as a tide, under the conditions that it left Radford. It would change in form entirely.

Q. Assuming that the Bluestone reservoir were partly empty, what would control the form of discharge in the stream below the Bluestone reservoir?

A. It would be entirely controlled by the operation of the power plant or gate at Bluestone.

Q. You first referred to the condition where the Bluestone reservoir might be full: Under those circumstances, what would be the effect, if any, of the Bluestone reservoir on any power tides from the Radford station?

A. The power tides from the Radford station would normally flow into the reservoir, spread out, and be reduced in height. If, as I understand the question, the reservoir were full, it would gradually spill over, increasing in volume as the depth increased, or it might pass through the power plant if the power plant were placed in operation and the demand for power be sufficient to utilize it.

Q. Assuming the Bluestone reservoir were full, and the Radford power tide spread out as you have described it on top of the reservoir, what would be the effect, if any, of that circumstance upon the form of the Radford power tide, if and to the extent it passed from the Bluestone reservoir?

2518 A. The form of the power tide would change entirely. It would simply begin to spill over as the level increased until a sufficient amount were spilled over to take care of the water.

Q. Would that involve the increasing or decreasing the amplitude of the tide?

A. It would decrease the amplitude of the tide. If the tide were very, very, small, and even then the spreading out would decrease any tide, as far as that is concerned.

Q. What, if any, use of the gates at the Bluestone dam could be made under such conditions to make the outflow uniform?

A. If the reservoir were full to the flood level, the gates could be used to control to the capacity of the gates and equalize the flow as might be desired, made large or small, but no smaller, of course, than the amount entering the reservoir.

Q. Well, would the gates be sufficient to fully equalize any power tide that could be produced by the Radford power plant, or not?

A. Yes, it is sufficient, I understand, to take care of action in flood, and the tide from the Radford plant, or any other plant, would be a comparatively small amount.

By Mr. JACKSON:

Q. Do you know what the hydraulic capacity of the Bluestone reservoir is in second feet?

A. Only in a general way. I understand it is about 10,000 second-feet—possibly a little more than that. I think it is somewhat larger than the proposed plant up the river, which is 9000 second feet, with the reservoir full.

Q. Dr. Mead, referring to this special condition when the part of the Bluestone reservoir reserve for power purposes might be full and the flow into the Bluestone reservoir in excess of the hydraulic capacity of the Bluestone power installation,
2519 or, as appears from Exhibit 145 in excess of 11,000 second feet, and the Radford power station be simultaneously operating on a peak load basis, please state whether in your opinion this coincidence of circumstances would be likely to occur?

A. It is very unlikely, I should say.

By Mr. JACKSON:

Q. Will you state the basis of your opinion?

A. There are so many provisions there, I think possibly in one or two of the preceding questions this morning, I misunderstood. I thought when you spoke of the Bluestone Reservoir being full, you referred to not only the power but to the flood storage. My answers were given in the first place with that in view. The general scheme of the Bluestone reservoir, of course, is to keep five feet for freshets, and I take it that that would be the usual course. It would be only under exceptional circumstances in which a freshet had just occurred and is then followed by a discharge of 11,000 feet plus the peak load from the plant above, a condition which is hardly conceivable.

Q. Well, Dr. Mead, assuming the Bluestone reservoir were full to the extent of the power capacity, and that there were an in-flow in excess of 11,000 second feet in the Bluestone reservoir, what, in your opinion would be the likelihood of the Radford plant being concurrently operated on a peak load basis?

A. The peak load capacity of the plant above at Radford would normally only be used for a very brief period, perhaps an hour or more in any one day. The coincidence of the peak in a

flood, either from above or below, a peak load at the same hour would be very unexpected and unusual and would hardly be anticipated to occur.

By Mr. JACKSON:

Q. Dr. Mead, assuming that the Radford reservoir were full, and there were a flow in the Radford reservoir of approximately 9000 second feet, state whether or not in your opinion the Radford plant would be operating on a peak load?

2520 A. In the operation of plants such as the Radford plant, it is the purpose to get as much power out of it as possible, and it would probably be operating as far as possible at the maximum load that could be carried. It might be no peak at all, but a steady discharge at or near its maximum capacity.

Q. Assuming the Radford reservoir were full, and there were a flow into the Radford reservoir equal to the hydraulic capacity of the Radford power installation, state whether or not in your opinion the Radford power plant would be operated on a peak basis during the continuance of that condition.

A. I should say not.

By Mr. JACKSON:

Q. Why?

A. A peak basis necessarily means that during the day the plant would be operated from a low basis to a high basis, the higher basis being what we would call the peak. With the capacity of the plant coming into the reservoir, I should consider the proper operation would be to run the plant as nearly to its capacity as possible, and practically eliminate all questions of peak and run it essentially uniform and as near the capacity of the plant as possible.

Q. Would it involve waste of water under those circumstances?

A. No waste.

Q. Dr. Mead, are you familiar with the power development at the navigation dams of the United States on the Kanawha River?

A. I know something about the capacity and location, but I have never seen them, and have never examined in detail the plans.

Q. Do you know what power developments have been built or are in process of construction at navigation dams on the Kanawha River?

A. I am informed that there are two completed and one under construction.

Q. Will you state whether in your opinion the potential power out-put at the Government navigation dams on the Kanawha River would be injured or benefited by reason of the existence and operation of the Radford power project?

A. It would be benefited.

2521 Q. Will you explain a little more fully the reason for your opinion?

A. The storage of water from the high flows and its release at low water is in general beneficial to power plants further downstream below the storage, and the benefit would result in either the case of the Radford plant alone or the Radford plant in connection with the Bluestone.

2522 Q. What effect, if any, would the existence and operation of the Radford power station have upon the low water flow available for power at the Government navigation dams?

A. It would increase the flow at the Government navigation dams.

Q. What effect, if any, would the existence and operation of the Radford power station have upon the head available at the Government navigation dams, available for power at the Government navigation dams?

A. When ever the Radford reservoir reduced the high water flow it would to that extent relieve the over-flow and the loss of head at the dams. I understand they are drowned out during extreme floods and the period which they would be drowned out would be shortened.

Q. Under what circumstances would the Radford reservoir reduce high water flows?

A. Under flood conditions in which water was being stored at Radford.

Q. What would be done with the stored water?

A. It would be held for power purposes during the low water period.

Q. Dr. Mead, in the course of your engineering experience, have you been familiar with the stream flow records of the U. S. Geological Survey?

A. I have.

Q. Assuming stream flow records of the U. S. Geological Survey, which indicate that the flow at an upstream gaging station for a given period of a week or more was substantially greater than the flow at a downstream gaging station, taking into account the lag in the flow from the upstream to the downstream station, what, in your opinion, would be the reliability of those records in the case of New River?

A. I should think it would lead to the conclusion of inaccuracy in the measurement, perhaps in the rating curve or in the data on which the rating curve was established or in the reading itself.

Q. At which gage?

A. At the upper gage that showed more water than would be found downstream.

Q. Will you state whether it might indicate the downstream gage reading was inaccurate?

A. It might indicate either one was inaccurate.

2523 Q. In your opinion, Dr. Mead, where an estimate of stream flow in the records of the U. S. Geological Survey for an upstream gaging station on New River, shows a greater flow than the corresponding flow shown by the same records for a downstream gaging station on New River, allowing for the necessary lag, could that discrepancy be explained or accounted for by losses due to evaporation or seepage?

A. Only in the event the difference was very small and not greater than the evaporation.

Q. Can you give any indication of the order of that difference?

A. Well if it was 100 second feet I should say it could not be due to evaporation.

Q. State whether the amount of evaporation would or would not be likely to be within the limits of errors of estimates in stream flow?

A. Commonly I think they would.

Q. How long and to what extent has your hydraulic work involved the study and use of U. S. Geological Survey estimates of stream flows?

A. Ever since there were any such records.

Q. For about how many years have you worked with U. S. Geological Survey estimates of stream flow?

A. I don't remember the exact date which the U. S. Geological Survey began their work. I remember there was some work done about 1893. When I first began work on rivers there were no Geological Survey measurements being made. They have developed in later years, and I think began somewhere after 1890. The first records are published in the annual reports of the Director and later they appeared and were called "Water Supply and Irrigation Papers." I think they are now called "Water Supply Papers," some six or seven hundred of them have been published.

Q. Please state from your experience what is the range of accuracy of the U. S. Geological Survey estimates of stream flow?

A. A great many of the earlier reports were quite inaccurate. That is, the readings were quite inaccurate, or the relation between the readings and the actual flow. They have greatly
2524 increased in accuracy with the experience of the Survey, but only as a general indication. I would not want to count on them closer perhaps than 5%, and the earlier ones were sometimes off a great deal more than that. That is, they were off sometimes very far.

By Mr. THOMPSON:

Q. You said the earlier ones were quite inaccurate. Would you give a figure there?

A. It depends upon the location. Some of the earlier ones were pretty fair and some entirely misleading. I always try to look into them as thoroughly as possible before using them, and I use the older records with a great deal of reluctance unless I have some substantial way of checking up their probable accuracy. The methods have been developed within the last few years, in fact the last ten years have been a very great improvement in the methods used.

By Mr. JACKSON:

Q. In engineering work do you accept the present estimates without checking them?

A. I always try to check any data we use as far as practicable.

Q. State whether stream flow estimates involve matters of judgment?

A. Yes, all measurements require judgment.

Q. Dr. Mead, have you any acquaintance with the Water Supply situation at Charleston, West Virginia?

A. I had at one time. I don't know just what it is at the present time.

Q. When did you last have any knowledge about it, as of what date?

A. I believe it was September 1930 when I was before the Commission at Charleston. The Commission asked me to go up and look at the works of the Water Company and to advise them as to whether or not they were doing all that could be expected in the way of furnishing pure water to the city. I did make such an examination and reported to the Commission informally, verbally, that I thought they were doing all that could be expected at that time.

Q. What was the source of the city water supply in 1930?

A. It was supposed to be from the Elk River.

2525 A. (Continuing.) The Elk River had almost stopped flowing and the flow was not at that time sufficient to furnish the needed water supply for the City of Charleston. The result was that the Kanawha River was flowing upstream and was flowing over some garbage, which the city had allowed to be dumped at the mouth of the river.

Q. Did you mean the Kanawha River?

A. No; the Kanawha River was flowing into the Elk, to supply water which the Elk could not furnish, which was polluted with garbage the city had permitted to go into the mouth of Elk River, which ordinarily would have flowed out, but at that time

was flowing in, and the water supply was polluted. They had to chlorinate the water, and were at that time furnishing very satisfactory water, as satisfactory as could be expected from a polluted source.

Q. Dr. Mead, are you familiar with the estimates of the U. S. Geological Survey as regards stream flow of the Kanawha River during the year 1930 and especially during the low water season of that year?

A. I have examined them. I haven't them all in mind. The records are here, I believe.

Q. I direct your attention to Water Supply paper #713 at pages 66 and 67, Exhibit #82, that is the record of the estimates of the U. S. Geological Survey for stream flow on the New River for 1930, and especially the low water season?

A. The two pages referred to are "The Kanawha River at Kanawha Falls", and the other page is "On the north fork of the New River, Crumpler, N. C."

Q. I direct your attention particularly to the first page dealing with the flow at Kanawha Falls, and ask if you are familiar with that?

A. I have seen it and looked it over.

Q. Will you tell me from your examination of Government Exhibit #82, Water Supply Paper #713, page 66, what was the estimate of flow for New River for October, 1930?

A. The mean or average flow is given as 1130 second feet.

2526 Q. Dr. Mead, assuming (1) that as testified by the witness Pierce in this case the mean flow at the Radford dam site was 759 second feet for the month of October, 1930, and (2) that all the new roller gate type of navigation dams on the Kanawha River and the new roller type navigation dam at Gallipolis on the Ohio River, were completed and in operation, and (3) that the requirements for maintaining the navigations pools on the Kanawha River at their project levels are not more than 200 second feet, what, if any, effect would cutting off the flow at the Radford dam site for a period of forty-eight hours during a month such as October, 1930, have on the navigation pools on the Kanawha River?

A. It would have no effect on navigation.

By Mr. JACKSON:

Q. Why?

A. Well, the difference between the two, that is, figures of the flow at Kanawha Falls and at Radford, would still leave 371 second feet, which would be ample for navigation if the amount of water used did not exceed 371 second feet.

Q. Have you finished, Doctor?

A. Yes.

Q. In that question I asked you, upon the hypotheses assumed, what would be the effect, if any, of cutting off the flow at the Radford dam site for 48 hours. In your opinion, would the result be any different, so far as the navigation pools are concerned, upon the hypotheses assumed if the cut-off were longer than 48 hours?

A. It would not.

Q. Why?

A. Because the flow would be sufficient to take care of navigation—the remaining flow.

Q. As a matter of practical operation, of the Radford power station, or any other station, with storage, would any other considerations affect the probability of cutting off the flow for longer periods of time during low water season?

2527 A. If we assume intelligent operations, no such condition should occur, for the purpose of the reservoir is to provide additional flow instead of subtracting from the flow at low water stages. It is the very purpose of the reservoir storage.

Q. Going back to the matter of stream flow, Dr. Mead, I neglected to ask you one question about which I wish to inquire. Do the same gauge heights at a given gauging station in a given stream always mean the same flow past that point?

A. Not necessarily.

Q. Will you explain the reason for your answer?

A. I presume I can show it better by a sketch, if you desire an explanation.

Q. Will you proceed then with your explanation?

A. I will draw a line representing the slope of the bed of the stream. In establishing the stream gauge we attempt to select a portion of the river that is fairly straight and fairly constant in condition, frequently selecting two stations more or less adjacent. The vertical line "A" represents one of the stations and "B" the other, depending on the size of the stream. It might be in a small stream not more than 50 feet, in a large stream a couple of hundred and perhaps in a large river like the Mississippi, half a mile. If I draw a line representing the flow of the stream when the same volume of water is passing station "A" and station "B", we have a condition that would ordinarily be called the normal flow of the stream. I was saying when the same amount of water is passing the station "A" and the station "B," we have a certain gradient and we normally call the condition the normal flow. Now, we have at various times during the season advancing and retiring floods, that is, the flood comes down the stream in increased flow. It can't pass this station without increasing the height and the corresponding

gradient. The flood comes on and we may come up to a point in here [indicating] and may get a temporary gradient represented by this particular line where the water is rapidly
2528 beginning to increase the volume at station "A" and beginning slowly to increase at station "B." The slope has increased and the amount of water passing station "A" is much greater at that particular time than the gauge height would seem to indicate.

Q. Mark the last gradient or last line you drew "C."

A. We will mark the first one "N" as the normal flow at that period. The new flow I might mark "N¹." The flood wave is coming in here and the conditions are not normal, not normal flow. Gradually this lower station begins to fill up and we get a condition perhaps where the flow at station "A" is higher than it was and station "B" has come up to a condition of normal flow, that is, with its higher water and under normal conditions the flow is the same at both points. As the flood goes by it may have risen considerably above the point I have marked "N¹" and the flood is beginning to subside, and there becomes a change and possibly we have a new line established, a line of flow where the upstream condition of gauge heights remains constant but the slope has decreased. Under this condition, which I will mark "3," "2," and "1"—"1" referring to the line with the greatest slope and "3" with the least slope. We might have all of these read at the same gauge height, but the amount of water passing would depend not only on the gauge height but on the slope, because it is slope that determines the quantity of water and that means simply the temporary advancement and retiring of waves. I think perhaps on the side, if I may be permitted, I might represent this by showing the formation of what we call a rating curve. The exact process of that is selecting the gauge point at which you wish to develop a regular gauging station. We measure the water ordinarily at the present time by a high grade current meter, which has been wonderfully developed since the early days. In my earlier experience we used to use floats where the selection of the channel was exceedingly important. We would take floats and time them between two stations. With varying distances across the river, their position would be carefully chartered and the time they passed the lower line, but at the
2529 present time we would probably start at this station and make observations at various depths and at various points in the cross-section. We would find that when this slope was an abnormal slope, that is, increasing more rapidly than the normal, the discharge by this point would be higher. In other words, our current meter readings might show—let me carry this point right across here on the gauge and I might determine it by three

readings under different conditions, advancing flood, normal flow, and retreating flow. This line would now represent quantities of flow and vertical gauge height. I might get, corresponding to this particular gauge height, three flows. When I determined other points, I would finally get a line in general corresponding to the curve that I have indicated there which I haven't made as heavy as perhaps you desire. That curve should pass through the point that I measured when the flow was normal. This point would mean that the flood was retiring, in other words, that the gradient was less than the normal gradient. This, which would show an excess flow, means that it was measured when the flood was advancing, when the gradient was more than normal and the quantity of water was greater. These would represent, and frequently do represent, such measurements, and then we are obliged to investigate the flow of the stream and establish a place where we can keep a constant watch on it. If we find a variation and if the work is accurate, it simply means they were made with a rising and falling river. If it is made with a normal flow we would get a series of points that would fall on the line. They will fall a little off, due to inaccuracy in the measurements, because, after all, a current meter is not an exceedingly accurate affair. It is only an approximate indication of what the stream or the body of water, canal, or whatever it may be, is flowing. It gives the velocity at various points in the vertical and also the horizontal of the cross-section and from that we establish a rating curve from which anybody can go to this gauge and read the gauge and turn to either a rating table or rating curve, which is a little more convenient, and find the elevation and read from the horizontal scale the approximate amount of water that is flowing at that time. The reading is off if there is a re-
2530 treating or advancing flood at that point. It is fairly accurate if the flow happens to be normal. I don't know how clearly I may have made this but it is a well-known condition that is familiar to everyone that is doing stream work. It is very common for a hydraulic engineer to have to make curves of this sort and observations because they are only made at certain locations on a river and we usually want to know what the difference is between the gauges that have been read by the existing facilities and the ones that would actually take place at the sites chosen for the development of the power plant.

Q. Dr. Mead, does normal flow, as you have used it in your illustration, mean the same as an established or steady flow?

A. I would say a steady flow, yes. I don't know what you might mean by an established flow.

Q. I meant the same thing.

By Mr. JACKSON. I will ask the reporter to mark the chart upon which the Doctor has just made a diagram used in connection with his explanation as Defendant's Exhibit 599. I offer the chart, marked Exhibit 599, in evidence as part of the testimony of this witness.

Cross examination by Mr. THOMPSON:

Q. Doctor, on that exhibit 599, isn't it true that the United States Geological Survey has slope correction methods by which these slopes are adjusted to normal and these apparent discrepancies corrected before the results are published?

A. They endeavor to correct them before they are published. They are usually issued in a preliminary form and later in a corrected form.

Q. And that is what we get when we get them in the books, do we not?

A. Supposed to be. Usually it is.

Q. Do you not think, Doctor, that the efforts of correction are quite successful and reliable?

A. Oh, I think in general, yes. I think they do admirable work.

Q. Doctor, I was very much interested in your statement of your qualifications, particularly interested in Boulder Dam as I have had something to do with it. The Boulder Dam Project was built, was it not, upon information to a very, very great extent derived from the reports of the Geological Survey?

A. The Geological Survey made, I think, the first investigations. The Dam was, of course, constructed after detailed
2531 investigations were made at various sites.

Q. Wasn't it true that when they had the dispute between the Seven States as to the division of water that they relied entirely upon the stream flow reports of the Geological Survey?

A. Well, I don't know to what extent they relied on them. As a matter of fact, those measurements at Yuma, of which they had twenty years' records, were not made by the Geological Survey. They were made by the Reclamation Service until very recently. They are now made by the Geological Survey.

Q. And didn't the records that they had at Lee's Ferry Dam or Lee's Ferry Bridge—you know where that is—up in Arizona?

A. Yes.

Q. Weren't they made by the Geological Survey?

A. I think they were. They are making them, I think, at all the stations on the river at this time.

Q. Did you happen to attend the meetings of the States when they had the hearing at Sante Fe out at Bishop's Lodge?

A. No, I did not.

Q. From your records and your reports and writings which I have read, and which are intensely interesting, isn't it a fact that there they had the Geological Survey reports and that the States accepted those reports as to stream flow without question?

A. It would all be hearsay. I wasn't there and I don't know what they accepted or didn't. As a general proposition I know that the Reclamation Service has accepted those: as a matter of fact, our Colorado River Board couldn't agree to them, because we found them very inaccurate. It is a very difficult place there at Yuma. I think perhaps it is one of the most questionable gauging stations anywhere in the United States.

Q. Isn't that due to the fact that the tides of the ocean come up there?

A. No, they do not, within 100 miles. They come up to the head of the Gulf of California, but that is 100 miles away from Yuma, or about that.

2532 Q. But there was no dispute, was there, about Lee's Ferry?

A. I don't know that there was any dispute anywhere except that our Board believed that the average annual flow of the Colorado River was greatly over-estimated.

Q. And you had estimates, did you not, from the Geological Survey reports up in Colorado and Utah and down in Arizona?

A. We used them from various places, on the Salt River, and on the Grand River, on the Rio Grande, and other places.

Q. And they are really the main source of information for engineers when they are out working on rivers, such as you have, in building dams?

A. The best source ordinarily available, yes.

Q. In the Colorado River, you talked about the subject of silt which was also intensely interesting and I believe that you were one of those, were you not, who said that this silt would be a serious question with the Boulder Dam and that they would eventually have to build some kind of a reservoir above there?

A. I thought, then, and still think that the silt proposition is a very serious one, and that the dam will ultimately be rendered entirely useless on account of the depositions of silt.

Q. And I agree with you on that, unless they do something to stop that silt. Wasn't there a very, very strong recommendation and almost a fight to have a dam put up at what is known as the Glen Canyon area on the river, so as to prevent this silt coming down, the Glen Canyon dam making a very long pool where the silt would settle gradually?

A. Well, there is a pretty long pool behind the Hoover Dam at the present time, nearly 100 miles long, I think. There was talk

of dams at points upstream. There have been so many of them that I don't recall each individually.

Q. Do you keep in touch with the Reclamation Service?

A. In a very general way. I know a great many of them and they send me most of the important documents.

2533 Q. Do you know that the Reclamation Service has given out the statement publicly, repeatedly, that the pool is already 100 miles back of the dam at Boulder Dam?

A. Yes; I understand it is.

Q. And that boats are running up and down there of fairly good size, that is, motor boats and the boats of the size of tug boats?

A. I don't know of anything except taking tourists up and down.

Q. And you knew, didn't you, from your study and your reports that the head waters of navigation was the Virgin River which comes down out of Zion Canyon?

A. I know that in the earlier times when the river was more open they did take small boats up as far as the Virgin River.

Q. They couldn't get a boat of any size up above Boulder Canyon but they would get out there and take what they call skiffs and go up as far as the Virgin River?

By Mr. JACKSON. I object to this as not proper cross examination. It has no relation to the examination in chief.

By the COURT. Objection overruled.

By Mr. JACKSON. May our exception be noted?

A. I know that there was some primitive navigation on the stream up to——

By Mr. THOMPSON:

Q. Virgin River. Now, you also said, didn't you, that there would have to be a re-regulating dam down below Boulder Dam?

A. I don't remember making any such statement.

Q. Don't you recall having made that statement before the West Virginia Commission in discussing the Boulder Dam?

A. I don't remember ever saying so. I didn't know that I mentioned the Boulder Dam before the Commission. I may have done so.

Q. I will be glad to show you a little later.

A. I will be very glad to see it.

Q. Would you think that a re-regulating dam would be necessary below the Boulder Dam?

A. Well, I don't know what its purpose would be. Of course, they are building a dam down at Parker now to take the water out for Los Angeles.

2534 Q. And the Parker Dam will be a re-regulating dam?

A. It would amount to that, I expect.

Q. In your report and writings on this subject, you recall, do you not, that there was no navigation for sixty years or more on the Colorado River from the Boulder Dam site down to Yuma?

By Mr. JACKSON. I object to that as not proper cross examination and having no relation to the examination in chief.

By the COURT. Objection overruled.

By Mr. JACKSON. May our exception be noted?

A. I know there has been no navigation there recently. I don't know how many years.

By Mr. THOMPSON:

Q. That is what the Seven-States Pact said, wasn't it, that there wasn't any navigation on there for the last sixty years?

A. I presume that is true, if it says so. I don't remember the details of what they said or didn't say, but there has been no navigation for a long while.

Q. Didn't they also find in this report on the Boulder Dam, of which I think you were a member, that the discharge from Boulder Dam would create a situation where they could have navigation from Boulder Dam down-stream?

A. I don't remember that.

By Mr. JACKSON. May our objection be noted to this as improper cross-examination?

By the COURT. Objection overruled.

By Mr. JACKSON. May our exception be allowed?

By Mr. THOMPSON:

Q. I would like to ask you about the situation on New River with respect to dams. I believe that you said that you had investigated the Radford site two or three times or it may have been four times?

A. I have been to the Radford site and made certain examinations and determinations.

Q. And you knew, did you not, that there were dams above the Radford dam?

A. Yes.

Q. There was Washington Mills Dam and the Buck and Byllesby Dams and then there were a number of very good dam sites, were there not, above the Radford dam?

A. I understand so. I never made any extensive examinations above, but I have no doubt that is true.

2535 Q. And you knew that there were dam sites below the Radford dam?

A. Yes.

Q. Some very good dam sites down the river, were there not?

A. Well, there were dam sites. I don't know what you may mean by very good ones.

Q. Where you could have created a pool and created power from them?

A. Sure, there were a great many places where you could do that along the New River.

Q. There was a dam site at Hinton, wasn't there?

A. About a mile above Hinton was the one that I examined.

Q. Then below Hinton there is the Sandstone Dam site? Do you recall that, about ten miles below Hinton?

A. No, I don't. I have never been to that. I have passed it on the train, but I don't know anything about it.

Q. You do know, do you not, in a general way, that the whole canyon or rather I believe they call it a gorge from Hinton down to Kanawha Falls, is susceptible of the construction of dams for the creation of power?

A. I presume that is true.

Q. And you know, of course, that the Electro-Metallurgical Company has a dam at what is know as Glen Ferris or Kanawha Falls?

A. I understand so.

Q. And that the Kanawha River is a series of pools created by dams?

A. Yes.

Q. So that as this New River and Kanawha River are looked upon, let us say, as one connecting stream, there is a situation where a great many dams could be located and power created?

A. Yes, I think that is perfectly true.

Q. You think also, do you not, that the creation of hydro-electric power on that river, should be under the control of one corporation; isn't that correct?

A. I think you would get the most out of the river by a single control, possibly. I don't know that it is at all necessary.

2536 Q. And if you had a competing corporation, let us say, down in North Carolina, but up-stream, that was controlled by a company in that State, might there not rise conditions where there would be some trouble between that corporation and the corporation down below, let us say the defendant here at Radford, if the two of them got into a very dry season and were trying to conserve water?

By Mr. JACKSON. I object to that as irrelevant and immaterial.

By the COURT. What is the purpose of that, Mr. Thompson?

By Mr. THOMPSON. I am trying to get the witness' view now as to stream flow and the effect of stream flow on this river. They have certainly spent a lot of time on stream flow—and

how it will affect navigation and is going to affect power and everything else.

By the COURT. Is it suggested that it would be advisable for the Federal Government to control everything on the river?

By Mr. THOMPSON. I didn't say the Federal Government.

By the COURT. But you said one authority.

By Mr. THOMPSON. I said one corporation, Your Honor. Isn't that a fair question?

By the COURT. It might be a fair question from a business standpoint, but I don't see that it has anything to do with the case.

By Mr. THOMPSON. Suppose that you had one corporation in one State that is expressing views and acting differently from what another corporation would want, wouldn't that create some situation on the river?

By the COURT. It might.

By Mr. THOMPSON. That is what I am asking him.

By the COURT. What has that to do with the merits of the case we are trying?

By Mr. THOMPSON. Because you might not have the capacity down below in your reservoir such as counsel have attempted to assume here, or you might. I just want to see.

By Mr. JACKSON. What reservoir?

By Mr. THOMPSON. Radford reservoir, Buck and Byllesby Reservoirs and Bluestone reservoir.

By Mr. JACKSON. There is no suggestion, if it is meant to develop that, that somebody in North Carolina might withhold flow. It couldn't have anything to do with this defendant.

By Mr. THOMPSON. I didn't say anything about withholding flow.

By the COURT. I don't see that it has any applicability to the issues in this case.

By Mr. THOMPSON. Your Honor, we have had this witness testifying to generalities to the extreme. I am now trying to bring it down to the concrete.

By the COURT. All the question implies, or any answer to it would imply, would be that it would be desirable to have a general authority to control the activities on that river.

By Mr. THOMPSON. Am I not permitted to test this witness as to his views, if we are going to have a general authority or separate authorities? To know how we are going to control the flow of the River?

By Mr. JACKSON. I don't see that that has anything to do with this witness' testimony.

By the COURT. It is all so vague, it seems to me, and indefinite. I think that is one of the things that we would generally

conc[illegible]e, that power development on the length of the Kanawha River would probably be more efficiently carried on if every plant were under the control of one central authority to coordinate their activities.

By Mr. THOMPSON. That is just the question I am asking him, and if he will say "yes" to that, I will pass right on.

2537 By the COURT. I think we can assume that. I think he has said "yes."

A. I don't think that was the question that was asked me. I say, in general, yes, you get more out of a stream if it is all managed intelligently and coordinated.

By Mr. THOMPSON:

Q. And if it were handled that way, that is, by one organization, you would not be liable to have friction, would you?

A. You ought not to. If a man has his own way he ought to get along with himself.

Q. So far as the control of the river is concerned?

A. So far as any business is concerned, control of the river or control of his power plant.

Q. Haven't you known people that had their own way and didn't get along with their own way?

A. I have known people that have had their own way and haven't got along very well.

Q. So that if you had your way about it, you would feel that the control of the creation of power and the operation of plants for creating power on New River, should be under one corporation, wouldn't you say?

A. Not necessarily. It depends on so many circumstances.

By Mr. THOMPSON:

Q. What are those circumstances?

A. Well, we have many rivers developed in Wisconsin where almost every power dam is under the control of a separate corporation that commonly have no relation to each other. I don't ever remember that we had any friction. We are not using the rivers in the most efficient way, however.

Q. In the Brule River that you testified to, that you built a plant on, you had a plant of very small capacity, didn't you?

A. I wouldn't call it a large plant or a very small one. There are many smaller and many larger. It is the only plant on the river, I think, at the present time.

Q. And most of those rivers that you speak of in Wisconsin, like the Brule and others, have only one proposition involved, and that is the question of power?

2538 A. The question of power, and, of course, that includes the question of storage.

Q. Storage and power, but no navigation, for example, on the Brule?

A. No, nothing except row boats.

Q. And you don't have any question of flood control there?

A. Essentially not; not for flood control; no, sir; except for storage, which is always flood control in a way.

Q. And you would not, of course, compare flat lake country conditions in Wisconsin, with conditions in the mountainous section through which the New River flows, would you?

A. I think some of our northern streams are fully as rapid and rugged in places as those in the Virginias. We have a development in one place on the upper peninsula of Michigan of about 600 feet.

Q. Which river is that?

A. I don't know that I can answer that; it is in the upper peninsula.

Q. Is that the Pigeon River?

A. I don't think so. It is a power development that belongs to one of the mining companies there. I have not seen it.

Q. That river is not navigable, is it?

A. None of those, no, sir; except that we are supposed to have navigable streams in the northern section of Wisconsin. This plant is in Pierre du Sac. I have never seen a boat go through it.

Q. You said that you were a partner of Colonel Scheidenhelm and that you had been partners for many, many years?

A. We have been associated in New York.

Q. And you were called in on this project, known as the Hinton project, generally speaking, were you?

A. Do you refer to the Hinton project as the project in West Virginia?

2589 Q. Yes, sir?

A. I never heard it called that, but maybe it is. The Hinton project where the dam—the first dam is about one mile above Hinton and the second about nine miles.

Q. That dam was to be a dam in this system of the Appalachian Electric Power Company, was it?

A. I understood so.

Q. And it was to be operated in its way similar to the Radford project? They were both being built, or were intended to be built, at about the same time, weren't they?

A. I understood so, yes, sir—the Radford proposition first and the others to follow. I never knew how they proposed to carry that out.

Q. This dam—originally you had the idea of building just the one dam at Bluestone or Hinton?

A. I don't know about that.

Q. When you were called in to testify before the Commission in West Virginia, Colonel Scheidenhelm was also called, was he?

A. He was there.

Q. Both of you testified at great length, did you?

A. I answered all the questions asked that I was prepared to. I don't remember now. It has been so long.

Q. He spoke first, didn't he?

A. I don't know about that.

Q. Do you remember whether or not he spoke at great length?

A. I don't remember.

Q. You don't remember that?

A. No, sir.

Q. Do you remember whether or not he outlined the position—the two of you were both representing the West Virginia Power Company, weren't you?

A. I don't remember, but we were representing people that had that interest in the dam. The names are gone from my mind and the details of my testimony are gone.

2540 Q. And you were appearing as an engineer of the firm to describe the situation to the West Virginia Power Commission, weren't you?

A. I could not even say if that was true. I was there as an engineer, but whether or not I was there as part of the firm or not, I don't know. We both made examinations there and gave such information as we had. I don't know that I can carry it any further than that.

Q. Who were you representing there at that time?

A. Well, I don't remember; they were the people that had the interests as to getting the license and the dams in West Virginia. What they called themselves, I don't know.

Q. That West Virginia Power Company you knew was affiliated with the Appalachian Electric Power Company, the defendent here? did you know that?

A. I know that the people that were interested in those two sites were also interested in the Appalachian Electric Power Company, yes, sir.

Q. And it is affiliated or owned and is a subsidiary of the American Gas and Electric Company, isn't it?

A. I don't know. I know they were related.

Q. I am mistaken about that—the Appalachian Electric Power Company, I should have said. I hand you what purports to be a certified copy of the Public Service Commission of West Virginia, by its Secretary Mr. Henderson, being Case No. 1548, West Virginia Power Company, Application for Permit to construct dams on New River for hydro electric purposes, (Blue-

ne Project), excerpt from transcript of proceedings and testi-
ny, marked Government's Exhibit 253 for identification, and
you to look that over and say if this is a report of the hear-
g, which you and Colonel Scheidenhelm attended?
A. (Witness examines record.) It is the same date as I recall.
what extent shall I examine it?
Q. Just that you recognize it—any of it?
A. I don't believe that I would recognize it but I don't doubt
that it is.
41. Q. May I find the place here for you?
A. Yes, here is the name "Mead" right here [indicating].
Q. There [indicating] is where you began.
A. It seems to be the direct examination. I see my name and
dress and my age and so forth. I presume this is a transcript
the testimony.

By Mr. THOMPSON:

Q. Doctor Mead, when you attended this hearing at Charles-
n, West Virginia, that I have been referring to, did you know
at there was a project being constructed or planned at Number
site in Virginia, near Pulaski, in Pulaski County, Virginia,
stream from Radford?
A. At or near Radford?
Q. Yes, sir?
A. I knew that was one of the proposed sites, yes, sir.
Q. Did you know it was to have the general characteristics of
e project at Bluestone?
A. I don't remember very much about the proposed Bull Falls
m or what the storage capacity was. I knew it was a high
m there. I knew considerable about it then, but it has slipped
y mind.
Q. You knew, away back in 1926, that this company, the West
irginia Power Company, had applied for a license from the
ate of West Virginia, for a single reservoir to be located at the
inton site, let's call it?
A. I don't know whether or not I knew it or not, at that time,
don't know. They may have done so. I don't question it, but
hether or not I ever knew it or about the history of it, I don't
now.
Q. Do you recall that there was great complaint that went
o from the Electro-metallurgical Company that waves coming
om the single reservoir would affect navigation below and affect
nditions in the lower part of the river?
A. I don't know that.

By Mr. THOMPSON:

Q. I read you from page 140 of Colonel Scheidenhelm's testimony. Colonel Scheidenhelm was speaking in answer to the question from one of the Commissioners.

2542 "A * * * so that coming back to your point, if there were enough water available, the power system operators would gladly get more than 50,000 kilowatts capacity out of the Bull Falls development during the low water, so that the water that is turned out will not be turned out for any altruistic motive, it will be turned out to generate energy. The load would demand it; it would be economically advantageous to do it. Now, the result of this upstream storage will be to make more water available. The Radford project is to go to construction practically concurrently with the Hinton development, assuming this Commission grants the license. They are economically related as is the Bulls Falls development. Have I made myself clear?

"By Governor CONLEY. I think so."

Q. (Continuing.) I ask you if you recall that statement being made by your partner, Colonel Scheidenhelm, at the time of the meeting of the Commission?

A. I do not.

Q. Do you agree with what is set forth in that statement?

A. I agree with it, so far as I understand it. It seems to be a little blind—the latter part of it there—if they were "economically related" as is the Bulls Falls development. I suppose they are talking about Bulls Falls and Radford.

Q. Do you recall that you testified about the amendment of your plans down there, which has been for one reservoir and you were now suggesting to the Commission that there were plans and drawings and so forth for two reservoirs, one to be at Bulls Falls, which was to be your peak load reservoir, and a regulating reservoir at Hinton. Do you recall that?

A. I know that was the plan at that time. I don't remember what they were for exactly. I know we were there about getting a license for the company.

Q. I will read here from page 203, and I am reading your testimony.

2543 "Q. What have you to say of the advantage or disadvantages of the proposed structures under the amendment of application of two dams over the original plan of one dam?"

"A. Well, I have been familiar with dams more or less for a great many years over the Ohio and it would occur to me that the principle use of power on West Virginia streams must be for peak power purposes. The single dams from an operating

standpoint would hardly be feasible financially. It would bring about such an interruption of flow, variation of flow, high flow and low flow, that it would seriously affect, I think, the operation of navigation in the lower river, whereas, with the plan as now proposed, with re-regulation, both purposes can be exercised in an entirely satisfactory manner. In other words, the upper plane and dip of the peaks, with the regulation of the lower plane, that would take care of the navigation and without injury to the riparian ownerships below the dam. Where a dam or stored water is to be used for several purposes, a re-regulating reservoir is very essential on the project. You asked me about the Boulder Canyon project. The time will come within not very many years when they will have to have a re-regulating dam below the Boulder Dam in order that water may be used for power purposes in lower Colorado and Arizona. The principles are just the same for the successful use of the water in these streams for the purposes for which I see them, and this present proposed proposition seems entirely satisfactory, while I should think the higher dam would be entirely unsatisfactory."

Q. (Continuing.) I am just asking you does that statement express your view.

A. I have no recollection of making a statement in that form.

Q. You have no recollection of it?

A. I don't remember. I don't understand the reference to Boulder Dam. We were anticipating the construction of a dam at Parker to take care of the Los Angeles supply, such
2544 dams as were necessary to—not to re-regulate but to divert the water to the points to be used. I don't know why I should apply re-regulation of the Boulder Dam itself. This matter in regard to the use of this dam—a re-regulating dam would adjust conditions of operation, which otherwise would have to be adjusted by station operation, which would be less desirable. I don't know whether there is anything in here that I cannot agree to at the present time. A dam built at that point might possibly be operated so as to modify the flow for use—with extreme conditions of peak. This was an advantage—I don't remember off-hand the capacity of this dam at present. That would have something to do with it. Was that about 50,000 kilowatts—it must have been more than that?

Q. No, sir; Bulls Falls is approximately as large as Radford.

A. Or larger?

Q. A little larger, and you had re-settlement of the lower dams—it would not be as much. You don't say that you did not say that, do you?

A. No, sir; I presume I did, although in a case of that kind, there are other conditions beside the one in any direct statement. It is hard to take a direct statement and say why it was made, without knowing the entire conditions that existed and on which the statement was based.

Q. Would you care to read the rest of your testimony?

A. If there are any other conditions other than those which were expressed there.

Q. I would be glad to have you read it over.

A. I don't think I have time to read that big volume.

Q. You didn't say so much. It is in very big type and you can scan over it quickly.

A. (The witness examines record.) I think I have covered that. There are some things here I didn't say. It is mixed up.

Q. To refresh your memory, you were there to advocate two reservoirs instead of one, were you?

2545 A. I was there to give evidence about the character of the proposed work to be done, if the license were granted.

Q. You said, in substance, before that Commission, if they had one project, with the high dam at Bluestone, and ran it at peak load operation it would be serious and dangerous for navigation down below?

A. Not dangerous. I think I said it would probably interfere.

Q. With navigation down below. You said, didn't you, that, it would seriously affect the operation of navigation in the river below?

A. I presume so, if it is there.

Q. Now, did you say that in this last statement that I have just read to you from page 203, and by that, I don't mean the sentence, but the entire statement—do you say you did not make that statement before the Commission?

A. What is the statement you refer to? Let me see it. You mean the full statement?

Q. Yes, the full statement.

A. No, I said if it is here, I presume I did.

Q. It is on page 203.

A. (The witness examines statement.) Well, it is mixed up. There are some things in there I didn't say.

Q. Start with the words "In other words."

A. (Witness reading.) "In other words, the upper plane and dip of the peaks, with the regulation of the lower plane, that would take care of the navigation and without injury to the riparian ownerships below the dam." I don't know what that means.

Q. If you take care of the peaks, and so forth?

A. By re-regulation.

Q. Isn't that clear?

A. (Reading.) "The dip of the peaks," which means that by regulating the peak flows, that you get better results. It is poorly expressed. I did not use these terms, I don't think, but the idea is, as I get it, undoubtedly it is essentially as stated.

2546 Q. You also said that without re-regulation of the dams—the operating of this project as a single project with peak loads, it would seriously affect navigation below, did you?

A. Essentially, that is, I think, essentially that is the statement there.

By Mr. THOMPSON:

Q. Doctor, I want to call your attention to statement on page 227 of the hearing before the Public Service Commission of West Virginia, Case No. 1548, West Virginia Power Company, Application for Permit to construct dams on New River for hydro-electric purposes; being Government Exhibit No. 253, marked for identification. This is cross-examination, Doctor. It says:

"Q. Professor, you have spoken of the control of the stream flow by the Hinton Dam, its relation to floods and its effect upon navigation in the Kanawha River. I want to ask if this control would result from the normal operation of the power plant, or would the operation have to be supervised to bring about that result?

"A. I don't think so; I think it would be supervised, if it brought about any other result but I take it the Hinton plant and power plant would be operated pretty close to 100 percent load factor; that is a continuous load which the power dams could develop, and the Bull Falls Dam would be peak load plant, that would fill up the pond after it had been drawn down by the continuous operation of the lower plant. That is my conception of the operation."

Did you make that statement in that hearing?

A. If it is there, I expect I made it. I do not recall the statement.

Q. Do you adhere to that statement?

A. I think that is substantially correct.

The COURT. When was this hearing?

A. September 1930.

By Mr. THOMPSON:

Q. The 30th day of September, 1930, your Honor.

By Mr. THOMPSON:

Q. I refer you to this same record, page 127, in which Mr. Schiedenhelm is asked to describe the method of operating the dams in generating plants:

2547 "Q. Please describe the method of operating dams in generating plants?

"A. That may involve to some degree repetition of what is contained in Amendment of Application on my earlier statement. The function of the down-stream development is to turn out water in a re-regulated or relatively equalized manner. The need for it arises from the plan of operating the up-stream of Bull Falls development in such a way as to carry peak loads. The carrying of peak loads is an economic necessity. That is the project cannot be justified unless it does that. By the carrying of peak loads means the operation of a power station intermittently or at least with great variation, as compared with what we style a base load or uniformly operated power station."

Do you agree with that statement?

A. I think so. I do not see anything different.

Q. That, then, is your understanding of the operation of a peak load project?

A. In general, I think so.

Q. Continuing on page 128:

"The Bull Falls power station can be expected to operate during the hours of maximum demand upon the power system into which it is to feed practically those hours or the daylight hours, the working days, outside of those hours, perhaps, even during the noon hour, the output of power from the Bull Falls Station will be curtailed or even cut down to zero. That means the outflow areas, but that intermittent output from the Bull Falls development will empty directly into the reservoir of Hinton development. In the Hinton development that water will be reregulated. That is, although there will be a varying quantity put into the reservoir, the output will be relatively regular and uniform compared with the input. It is a necessary characteristic, as I believe I pointed out, that the downstream res-

2548 ervoir, reregulating reservoir, shall have sufficient storage capacity to allow for the accomplishment of that result. It does have that necessity. In brief, then, the method of operating the project will be to operate the Bull Falls development intermittently as a peak load carrier, and the downstream plant, that is the Hinton power station, with relative uniformity."

Do you agree with that statement?

A. I do not see any point in it that I do not agree with it. I think it is essentially correct. It is not my language or my statement.

Q. No, that is Col. Scheidenhelm's.

A. Yes, I understand.

Q. Reading from page 138 of Mr. Scheidenhelm's testimony:

"Q. I still don't catch your idea, Colonel. Do you mean to say that if the water is not necessary to carry the peak load that you would let the water down through the dam during the dry period in order to keep the normal flow going?

"A. That might be the case, and the power company might be altruistic enough for that, but the fact is there is a need for the peak load and the operators of the power system would only be too glad if they had more water available. They are limited by the available water.

"Q. That would depend on the demand for power, wouldn't it?

"A. But that cannot be conceived, reasonably, even in times of business depression, not to require all the output possible."

Do you agree with that statement?

A. Well, I did not get it very clear. It seems to be an extract. I think it is essentially correct, if I get the meaning of it.

Q. Do you understand, Doctor, that there is, even in the most depressing times, a sufficient demand for hydro-electric power on the New and Kanawha Rivers to call for and consume all of that hydroelectric power?

A. I understand so. yes.

2549 By Mr. THOMPSON:

Q. You were present with Col. Scheidenhelm when he testified, were you not?

A. I don't remember. I was a part of the time. Whether I was there during all his testimony, I do not know.

2550 By Mr. THOMPSON:

Q. I want to read you from page 107. This is Col. Scheidenhelm speaking. It is by Commissioner Mahood.

"Q. What have you to say to the advantages or the disadvantages of the amended application of two dams over the original plan with one dam?

"A. The following considerations appear to me to be outstanding and they are all advantages in favor of the change from one dam scheme to a two dam scheme of development. First, the Bluestone project in its original form would have been economically feasible only after reliable examination; that is, after reliable examination for carrying big peak loads. Of necessity this would have resulted in greatly fluctuating stream flow in New River down-stream from the power site. and in particular from the power site and the junction of New River with Gauley River or, in other words, the head of navigation on the Kanawha River."

Do you agree with that statement?

A. I am sure you will have to let me see that to get it through my head, just what the statement is.

Q. Starting right there and going over here (handing witness record).

A. In answer to that, I would have to say this: Col. Scheidenhelm has gone very much more into the study of these various proposition than I. Some of things he said I could not substantiate because I have not gone into them. I do not doubt but what that is essentially correct, as near as I know, but I do not pretend to know as much about it as the Colonel, because it was under his immediate charge, and I was looking into general phases. I would not like to substantiate everything that is said there. Some of it I have no knowledge of at all. He has the knowledge, and I have no doubt that he is correct. I could not say I know it all. He had it under his immediate charge.

Q. Hadn't you made a study of this situation before you went before that Commission?

A. I studied certain phases of it before I gave evidence.

2551 Q. You gave evidence with respect to the peak loads and the operations down the river?

A. I think you read it this morning and I stated it.

Q. Let me read you [continuing on page 108]: "Secondly, it is believed by me, from the standpoints both of downstream riparian owners and water power developments, and also of the best interests of navigation on the Kanawha River, the applicant power company would not be justified in taking the risks of constructing or attempting to construct the original single stage Bluestone project, with its 140 feet dam at the Hinton site, inasmuch as that dam and power station, and in particular the operation of the power station, would be dependent upon the legal right and the practical ability to operate that power station primarily for carrying peak loads. The carrying of the peak loads means fluctuating output from the power station. In other words, variation in stream flow downstream from the power site." Do you agree with that statement?

A. As far as I know. I never made any study of the economics of this construction.

Q. Well, isn't this more than economics?

A. It is variation in flow and its possible legal effect on investment, I should take it. It sounds very reasonable, and I think it is correct, but you are asking me to confirm a lot of things I never stated, and I would like to have my position clear on it.

By Mr. THOMPSON:

Q. Let me ask you about a statement on page 109.

Mr. JACKSON. A statement by whom?

Mr. THOMPSON. Col. Scheidenhelm.

By Mr. THOMPSON. "Thirdly, under the present scheme of development, which is the scheme proposed in the Amendment of Application, such peak load operation, with extreme variation in water output from the power station, can be carried on to the maximum practical degree at the upstream or Bull
2552 Falls development without any resistant interference with the rights of riparian owners or with navigation or the navigable capacity of the Kanawha River. The operation of the Hinton development will be subject to the necessity of reregulating the discharge of water from the Bull Falls development, and it has the function of operating and will be operated so as not to interfere substantially with navigation on the Kanawha River or with the rights of downstream riparian owners." I assume you agree with that statement, don't you?

A. Yes; I agree with that.

Q. Now, on page 685, Mr. Scheidenhelm has been recalled, and Commissioner Nethken is examining him: "When you speak of Hinton and Bluestone, you are referring to the same development?

"A. I should not have used those words, if I did.

"Q. When you referred to Bluestone, what did you mean?

"A. When I referred to the Bluestone project I intended to refer to the combination of the two developments. That is a sort of a preamble to the explanation of the fact that this hydroelectric development will not always have available to it the water to meet the demands up to the capacity of the machinery. Now, in the two developments or power developments of the Bluestone project, it is proposed to install a total of 142,500 kilowatts; out of that total, in the neighborhood of one-half, in fact, less than one-half, or approximately 52,000 kilowatts of capacity would be available even during the low water year. Let us say 1925, which is our practical measuring stick, for that purpose, and that capacity would have been available not for all the time throughout that low-water season, but only the basis of 25 percent load factor, that is throughout that low-water period, utilizing all the available storage of the Bull Falls reservoir, that capacity of 52,000 kilowatts could have operated reasonably only 25 percent of the time. Naturally that is for the best interests of the power company, but it is in-
2553 tended to feed that 25 percent of the time, which would be allocated to the periods of maximum low demands. It

is the equivalent of six hours per day. Practically, I think it would result in operating for five days of the typical low-water season week, over a length of time in excess of six hours, and operating on Saturdays for a longer time than six hours and probably on Sundays not at all, so far as concerns the Bull Falls development, while the Hinton development is going along with comparative regularity, with this total of 52,000 kilowatts." Do you agree with what is contained in that statement?

Mr. JACKSON. I object to that as a statement of fact.

The COURT. You may answer.

Mr. JACKSON. Exception.

By Mr. THOMPSON:

Q. Is that the proposed method of operation?

A. I assume it was if Col. Scheidenhelm said so. I do not see anything there I differ with. I have not made study enough of the hydrographs of the low year to know whether it is just 25 percent or what, but I should judge that it is practically correct, and I think it is fully correct if that is the Colonel's testimony because he had made a thorough study of it.

Q. Doctor, you testified Friday with respect to silt in the Radford project, and, as I recall it, that the silt that might come down that stream would be caught in and held in the Radford project, except a very small amount which would go over the dam or be carried down the river. Is that substantially what you testified?

A. Substantially so; yes.

Q. Now, do you know where the Washington Mills reservoir is?

A. No; I do not.

Q. Upstream?

A. Is that upstream?

Q. Yes; it is up above the Buck and Byllesby.

A. No; I don't recall that. I know that there are some up there.

Q. Do you know how old that dam is?

A. No; I do not.

Q. Do you know the depth of silt as testified to in that
2554 reservoir by Dr. Barnes?

A. I heard your statement this morning. That is the only way I know.

Q. He testified on page 3889 that that dam, which is 33½ years old, has now a silt capacity in it of 80 percent. I call your attention also the fact——

A. (Interposing.) A silt capacity of 80 percent?

Q. Probably the word "capacity" is not the right word—silt deposit?

A. 80 percent of its capacity is filled up?

Q. Yes; that is right. He also testified that the Byllesby dam and the Buck dam are both 23⅔ years old, and that the Byllesby reservoir is silted to the extent of approximately 60 percent.

A. Is that the lower dam?

Q. That is the upper. Then the lower dam, which is the Buck, being of the same age, is silted to the extent of 20 percent?

A. Yes.

By Mr. THOMPSON:

Q. When a reservoir fills with silt, that destroys what we call channel storage to the extent that it is filled with silt, does it not?

A. I could not agree with your terms. I would not call it "channel storage." It is reservoir storage.

Q. Maybe I am, in my layman ignorance, incorrect, and I accept your statement.

Q. In other words it does destroy, what did you call it——

A. The reservoir storage.

Q. It does destroy the reservoir storage?

A. If it occurs in the area of the usable storage; if it gets into the bottom where we don't expect to use it, it don't do any harm whatever.

2555 Q. If you had that occur in a number of reservoirs on a river it to that extent might be serious at flood times, might it not?

A. I don't see just how.

2556 Q. Supposing Boulder Dam fills up with silt, will the problem of flood waters be any more serious than if you didn't have Boulder Dam there?

A. That is a pretty large question.

A. I don't see that it would.

Q. Wouldn't the water come rushing down there and spill over the dam without any chance for reservoir control?

A. Well it would have to cover the reservoir surface. If it was full of silt it would cover over the silt surface until it would come high enough to go over the spillways.

Q. And in Boulder Dam you have what is called a "box canyon" and that would easily happen if your reservoir were filled, the water would rise very high and go over the dam?

A. It would rise and go over the spillway if the reservoir were full of silt.

Q. Wouldn't you have a more serious problem with flood control than if the Radford project was not there at all?

A. I can't say you would.

Q. Wouldn't your storage capacity be gone if the dam was filled with silt, wouldn't your channel storage capacity be gone?

A. Your reservoir storage capacity would be gone, but if you had that reservoir filled with silt and the flood come down it would necessarily spread out over that whole reservoir and begin flowing over the dam.

Q. Whereas, if you didn't have it filled with silt you would have some opportunity, would you not, to catch the water in the reservoir and hold it back?

2557 A. That is what the reservoir is for, and it certainly would. The question you asked is so complicated it is hard to see its meaning or give you a definite answer in regard to its effect.

Q. Let us take the Bluestone reservoir. You recall, do you not, that one of the requirements of the Bluestone reservoir was that it should have a minimum discharge in low-water times of 2,000 second-feet?

A. I think I heard that; yes.

Q. And also one of the purposes of the dam was flood control?

A. Yes; I understood that.

Q. And there was also another purpose, and that was a usable storage for the creation of power?

A. Yes, sir.

Q. And I suppose also for navigation purposes, that is usable storage would naturally go down the river and would affect navigation, would it not?

A. I would consider it so.

Q. If the Bluestone were seeking to maintain its head there for the creation of power by keeping the usable storage part of it filled, and a flow came down from the Radford project, under such a condition would not the Bluestone have to let that water go through or else preempty some of its surcharge or flood storage?

Q. We will assume the Bluestone was not discharging any water for the purpose of creating power?

A. It would have to be used, stored, or wasted.

Q. If it were stored it would begin to occupy the space allowed for the surcharge of flood storage?

A. If the lower space were filled; yes, sir (R. 6083–6087).

Q. Let us assume that under the 308 report 2,000 second-feet are being discharged by the Bluestone and the Government is maintaining, or seeking to maintain, its usable storage capacity,

and it has a surcharge storage above that for storms or high water if a flood comes down the river from the Radford project of 9,000 second-feet, will not the Bluestone have to
2558 take care of that 9,000 second-feet in the surcharge or flood part of the dam or else let it go through?

A. It either has to be stored, wasted, or used.

Q. Let it go through, I don't mean wasted?

A. Let it go through, that is what you mean by wasting it. I take it the very purpose of that upper part is to store floods and prevent damage downstream, and I don't understand why a flood of that nature wouldn't be regulated in the upper reservoir. That is what it is for, isn't it?

Q. But the Government is standing there, as I understand it, with an insurance to protect the situation down below, so that if a great storm comes rushing down they will have a storage capacity under the surcharge to take care of it; therefore, it is the Government's purpose to keep that surcharge in the clear all the time.

A. And not use it when needed?

Q. Have it always ready for storm conditions?

A. That is a distinction I can't quite comprehend.

Q. Supposing that they let that surcharge get filled with water?

A. Why should they let it get filled with water, they would use it to regulate with, wouldn't they; that is what it is for?

Q. It is to regulate flood control?

A. Any water that comes down the stream is a part of flood control, isn't it? It isn't labeled rainfall or flood.

Q. I understand there are certain flows described in the 308 report which under certain conditions this surcharge would have to take care of?

A. I understand it is to take care of any increase in flow that needed regulating.

Q. Your answer is that water would either have to be taken care of in the surcharge part of the reservoir or it would have to go through?

A. Under your assumption; yes, sir.

Q. If it went through, wouldn't it create a wave the same as if there hadn't been a reservoir there?

2559 A. I don't suppose it would differ very much from one that would go down the stream from away up above if the reservoir had not been built. A diminishing flow always occurs down the channel, and it would diminish in this reservoir, the amount that started over would be small at first, and as the reservoir fell it would increase.

Q. Do you know what the capacity of the gates at Bluestone are?

A. I don't recall them. I suppose for about the maximum flood.

Q. You do understand, do you not, the Bluestone cannot take care of all the run-off of the watershed above it?

A. It is limited of course to its storage capacity.

Q. Which is not sufficient to take care of it all?

A. I don't know if that is true or not. I assume it is. I wouldn't think it would be sufficient to take care of the total capacity of a large flood.

Q. It isn't sufficient to regulate the flow of the New River?

A. I wouldn't imagine it would be.

By the COURT. Is there any reason why you can't completely regulate the flow excepting at such periods as the natural flow rises above 11,000 cubic feet?

A. The natural flow at times of flood, as I recall it, sometimes runs up as high as 75,000 second-feet, and the floods long continued I should not think 235,000 acre-feet would be sufficient to smooth that out so you could make a normal or uniform discharge. I should think it would take a number of times that capacity, your Honor.

Q. Doctor, you said that in estimating the necessities for a reservoir such as the Radford reservoir, I believe you allowed for a capacity much larger than the largest flood record, is that right?

2560 A. I don't get that question.

(Question read.)

Q. I should have said the discharge, you make an allowance for much larger flow than would have to be taken care of in the highest flood condition you know of?

A. We commonly use the factor of safety. I mean by that, we provide for a flow greater than has ever occurred because of anticipating an excessive flood sometime in the future.

Q. And in your Radford project you did allow for that very much larger discharge?

A. I have no doubt we did, because we never do otherwise. I don't remember the details of that, though. I know well enough that it was done, but just how it was done or what allowance was made, I don't remember. I don't know that I ever knew.

Q. Also with respect to the average flow under minimum conditions such as, I think, you have fixed at 1,200 second-feet, you allow for the lowest years that you know about?

A. Yes.

Q. Isn't it possible, Doctor, for a drier period to occur than has ever occurred before?

A. Yes.

Q. So that it is possible to expect an even less run-off than we had in 1925 and 1930?

A. Yes.

Q. Why is it that the defendant here, did not figure a possibility of that kind; as I understand it, in fixing this average flow, you fixed it on the basis of the lowest flow of 1925 and '30?

A. I think I stated in my direct testimony that it would be the part of wisdom to keep somewhat below that in order to provide for a contingency of an extraordinary year. That is, the aim of our experience, that we must not be above that. How much below it would depend on how extreme the low years have been. If we thoroughly believed they never could be exceeded as a minimum we would work right up to it. If we had lim-
2561 ited experience and were quite confident that at some time it would be much less we would keep considerably down from it.

Q. The thing that has struck me, if I may suggest it to you, is that the engineers figure on something much higher in the way of floods than has ever occurred but they don't figure apparently on something much lower than the dry periods have shown?

A. I think they do. I think they try to provide for it in the way I suggested. The extreme of the flood is likely to be so much more severe in its effects, so much more serious, that we probably give that greater attention on that account. If you double the floods it might be a very serious thing.

Q. Floods have been on the increase, haven't they, from time to time?

A. I don't think so. I don't think they are any greater than they always have been for the last thousand years.

Q. When did you learn about this rule curve of 1,200 second-feet?

A. I don't know what you mean by rule curve.

Q. I don't know either, but I understand that is what counsel likes to call it.

A. I don't know. From what I have heard about it, it is a thing that we figure out very often. We make a hydrograph that shows the low-water conditions, and how it sinks below the level of the common discharge and the amount that sinks down gives a study of the reservoir capacity we have got to have and what the minimum flow would be under those special conditions and from it we can also judge if the conditions were greater, more serious, what effect that would have.

Q. Did you accept from Mr. Scheidenhelm, or whoever informed you, this figure of 1,200 second-feet?

A. Well, I saw the curves on which t...y were based, both the curves of '25 and the curves of '30. I didn't check them up in detail, if that is what you mean, I didn't check them up.

2562 Q. Those curves, as applied in a practical way, to this 1,200 second-feet, would requ're you to know the capacity of the reservoir, would they not.

A. Well, to determine the quantity of low-water flow you would have to know the capacity of your reservoir, or, on the other hand, in order to determine the capacity of the reservoir you needed, you would take that from the same study.

Q. Has anybody ever given you the actual capacity of the Radford Reservoir?

A. I don't suppose the actual capacity of any reservoir is known except approximately.

Q. That may be, but I mean the capacity that the defendent is proceeding on?

A. The capacity that I referred to is the capacity for utilizable storage and that has been determined, as I understand, by surveys which show it at 100,000 acre-feet. I didn't make those surveys and I don't know whether that is true or not, except that I accept the Colonel's statement.

Q. In other words, you have never seen drawings which show the actual area of that reservoir, have you?

A. Well, I don't know how a drawing could show the actual capacity of a reservoir. I have seen the capacity curve that shows the capacity of that reservoir to be 100,000 acre-feet.

Q. Have you ever seen topographic maps of the base or surface of that reservoir?

A. I don't recall whether I have or not.

Q. You don't know whether they are in existence or not?

A. Well, I have seen some maps of the reservoir, but whether they are what you have reference to or not, I haven't any idea.

Q. Were they completed maps or where did you see them?

A. Well, I saw them in the field and in the office. They were completed as far as the work we were using them for at the time was concerned.

2563 Q. Whose office did you see them in?

A. The New York office. I think we studied them there. I think we studied them in an office down in the field. I don't remember just what little place it was. It was up at the Crossroads.

Q. Do you remember when you saw them?

A. No.

Q. Would it be three weeks ago or a month ago, would you say?

A. A year or two; two or three years ago, I would say. It was at the time the investigations were being made for a dam site and to determine the tightness of the reservoir and other matters of that sort.

By Mr. THOMPSON:

Q. Doctor, you estimated, I believe or figured on the basis of an average minimum flow of 1,200 second-feet from the Radford project; is that not correct?

A. I estimated from the curves that I have that the maximum average flow through the extreme dry season would not exceed 1,200 second-feet.

Q. And that curve was supplied you, as I understand it, by somebody else?

A. Yes.

Q. I notice all the way through in your testimony you emphasize the word "average" and, as I understand that use of the word, that would permit the company for part of a day, let us say, or part of two days—I think you went as far as two days—to drop below the 1,200 second-feet and at other times to go above 1,200 second-feet. Am I correct in that understanding?

A.—Yes; I think so, in a way. Of course, the 1,200 second-feet is what would normally be added to the dry-weather flow. No; I am mistaken about that. I mean you would add enough to the dry-weather flow to bring it up to approximately 1,200 second-feet. You might choose that one hour four times or five times or six times. That average would be over 24 hours, and in ten or twelve hours you might not use it at all, but the
2564 average use during any particular period ought not to exceed 1,200 second-feet, and it preferably should be kept below that for the reason I have already explained.

Q. So that you could close down, as you say, for from 10 to 12 hours at a time and still keep that average?

A. Yes.

Q. And you could flow the stream or discharge up as high as 9,000 second-feet, could you not?

A. Yes; with a full reservoir.

Q. Next Monday is Labor Day. Couldn't you shut-down from Friday night until Tuesday morning?

A. I suppose you could shut-down indefinitely if you wanted to, if there is any occasion to. You wouldn't expect to do a thing of that sort in any reasonable operation of the plant.

Q. That is just what I want to talk to you about for a moment. You are a thoroughly experienced engineer and we all acknowledge it. Aren't there reservoirs that do close down from

unexpected reasons for quite long periods of time in systems like the Appalachian?

A. Well, that is a pretty broad question. I wouldn't want to answer it either yes or no. Of course, we build reservoirs and close them down entirely and collect all the water that flows for irrigation purposes.

Q. That is a different situation.

A. Yes; that is quite different.

Q. But I am thinking now in terms of power projects.

A. As a rule, we do not shut-down a reservoir that is used for power purposes in this eastern country entirely; that is, we always expect to let the normal low-water flow proceed. The general proposition is that our reservoirs uniformly are to take off the peak, maintain the low-water flow which ordinarily we don't consider that we have any business to stop.

2565 Q. Didn't it occur on quite a few occasions—I wouldn't say often—but quite a few occasions during what we call the panic period when there was such a low demand for power that some of these reservoirs were closed down?

By Mr. JACKSON. In low-water periods?

By Mr. THOMPSON. In low-water periods.

A. Well, I couldn't say about that. I don't keep posted on all the reservoirs in the country.

Q. Do you know the Martin Dam in the Alabama Power Company system?

A. No; I only know concerning that system in a very general way. I don't know about the storage.

Q. You don't know that that dam was closed down for 84 days at one period?

A. No, I don't know anything about it.

By Mr. JACKSON. During low water?

By Mr. THOMPSON. During low-water period.

By Mr. THOMPSON:

Q. And you don't know that it has been closed down on thirty different occasions from five to seventeen days?

A. I don't know anything about it, so most any question you can ask me I don't know.

Q. I don't want to go beyond what you know about it?

A. I don't even know where it is.

Q. In your dams up in Wisconsin, they do close down from time to time, don't they—up on the Brule?

A. Our plants?

Q. I should say plants.

A. I am trying to think of any time they have been closed entirely. I don't know of any.

Q. Wasn't the Brule dam closed down in 1930?

A. It might have been. I don't know. I doubt if I knew much about it at that time. The company had sold that plant, I think, to the North American Company some years earlier than that, and I think the records of operation were sent to our office and we were advising them for some years. I don't know whether we do yet or not.

Q. You look after the western business of your firm, don't you?

A. Well, yes and no. I have some work that is done in connection with Colonel Scheidenhelm and some that has
2566 been done in the past with my associate, Mr. Seastone, and some I have done individually.

Q. You wouldn't say that none of those reservoirs that are under your jurisdiction out west were not closed down for quite a period of time, let us say several days or as high as two weeks during 1933?

By Mr. JACKSON. Low water?

By Mr. THOMPSON. In low-water times.

A. I don't know any reservoir that would be closed down except the reservoirs on the head waters and they are closed down at all times except when more water is needed.

Q. In other words, they are storage?

A. They are storage reservoirs, built at the headwaters and owned by the combined water power interests on the stream and opened up only as the water is needed.

Q. Are any of those power reservoirs?

A. No; those are not power reservoirs. They are simply storage reservoirs, very much like those at the head of the Mississippi.

Q. I have here Defendant's Exhibit 594, which shows the Radford curve as applied to the system of the Appalachian, and ask you if that doesn't show a variation from zero to 9,000 second-feet?

A. It does.

Q. I was also interested in your qualifying language in answer to counsel, in which, talking about the 1,200 second-foot phase of the question—I am reading from page 5966:

"A. With a full reservoir there would be some very slight draft in June. I am supposing, if intelligently used, there would have been some slight draft in June."

I noticed that you made that qualification all the time. Aren't there times when reservoirs are not intelligently used? Human beings make mistakes, do they not?

A. I suppose that may occasionally occur.

Q. On Page 5967, you said:

"By Mr. JACKSON. Not more than 1,200 [meaning, I presume, second-feet].

"Q. Under that method of operation, would the storage be exhausted at any time prior to the end of the low water season?

2567 "A. Not unless—I don't know that it ever gets so low so you can't find some time it might go lower and therefore you should cut under 1,200 feet. It may occur."

And you left there a reservation that such a condition might occur, didn't you?

A. Yes.

Q. There might be such a condition arise?

A. Yes.

Q. Then you said on the same page:

"Q. You said in the first part of your answer, assuming at the commencement of the low-water season the reservoir was full; please state whether, in your opinion, under proper operation, the Radford reservoir would have been full at the commencement of the low-water season early in June?

"A. Under proper operation it certainly should have been filled and practically full at the time of the low-water season."

You have the assumption there of the proper operation of this project and might not one man's judgment differ with another as to proper operation?

A. Not radically. The principles of operating a reservoir are so nearly fixed that there couldn't be very much divergence or difference of opinion on that subject.

Q. And then turning over to 5968, you said:

"Q. Would you consider it a reasonable or an unreasonable method of operation, if, under conditions disclosed in 1930, the utilizable storage of the reservoir had been depleted or exhausted prior to June 22nd or 23rd 1930?

"A. I should consider it an inexcusable blunder.

"Q. Are you familiar with the load requirements of the system of the Appalachian Electric Power Company?

"A. No; I don't know anything about it except in the way as I have stated of load curves in pretty near all the country in the main plants. I do not recall that particular load curve. I may have seen it and presume I have."

2568 Are you familiar with the report that Major General Taylor wrote to the Federal Power Commission in 1925, December 29th, in which he said that this Radford reservoir could be closed down indefinitely insofar as navigation down below in the Kanawha was concerned? Are you familiar with that?

A. I don't recall it. I may have seen it, but I don't recall the particular report.

Q. You regarded General Taylor as a distinguished engineer, did you not?

A. I don't know. Was he Chief of Engineers at one time?

Q. Yes.

A. I have only known him in a general way. I have known many of the Army Engineers and they are very able men, all that I have known.

Q. If he had said that the reservoir could be closed down indefinitely, then if it was to the benefit of the power company to close it down for any reasons, accident, mood of some person, or demand of the directors, that could have been done, could it not?

A. I suppose it is physically possible.

Q. But you don't think that that would be probable?

A. I can't see any reason for doing it. I think it would be a very peculiar condition that would bring about anything of that sort. I can't see any reason.

Q. You would admit, would you not, that it could be closed down indefinitely?

A. Well, it has to be made so it can be closed off, as far as that is concerned.

Q. Are you familiar with the license that the State of Virginia has granted to the defendant?

A. No.

Q. Did you ever hear of the license?

A. Yes; I heard there was a license but I never read it.

Q. Are you not familiar with that?

A. No; I am not. I knew there was a limit fixed of some kind but what it was I haven't inquired.

2569 By Mr. THOMPSON:

Q. I am reading again from General Taylor's report of December 29, 1925, that paragraph which I have already read:

"It may be assumed as a possibility that the plant might be closed down completely for an indefinite period of time during a dry season and at a time when the storage above the dam had been drawn down."

Now, Doctor, I am asking you if you consider that is a possibility?

A. I do not.

Q. So that you don't agree with him there?

A. No.

Q. Second: "In the event of such a combination of circumstances, all water from the drainage area above the dam would

be shut-off until the reservoir filled or until operations were resumed." Do you agree with that statement?

A. If what he says is conceivable, that would follow; I would agree that far, yes, sir.

Q. And now this—this is next to the last paragraph (reading). "Therefore, so far as can be predicted from available data and records it would not be possible to operate the proposed project so as to adversely affect navigation on the Kanawha River under the existing project."

By the COURT. The paragraph read to the witness indicates they are somewhat contradictory, some of them. One of recites the possible shutting off of the water and immediately jumps to the conclusion that that would not affect navigation. There is an intervening paragraph.

By Mr. THOMPSON:

Q. This is the paragraph alluded to (reading):

"The drainage area above Dam No. 2, the upper dam in the Kanawha River, is 8,470 square miles. The drainage area above the site of the proposed dam is 2,396 square miles. The
2570 drainage area between the proposed dam and Dam No. 2 is therefore 6,074 square miles. Records of the measured flow for the years 1909-1916 are available for streams which drain a total of 3,714 square miles of this intermediate area. From these records the total flow of the drainage area below the proposed dam has been computed for each month of the years for which records are available. It is found from these computations that the run-off from this drainage area below the proposed dam is sufficient to supply the necessary water for navigation on the Kanawha River under the existing project."

By Mr. THOMPSON. Then comes the last paragraph. [Reading:]

"Therefore, so far as can be predicted from available data and records, it would not be possible to operate the proposed project so as to adversely affect navigation on the Kanawha River under the existing project."

By Mr. THOMPSON:

Q. (Continuing.) That was written in 1925, before any new dams were constructed. Do you agree with that statement?

A. Assuming that each of the preceding conclusions is correct, that conclusion would follow. I would agree, if the statement is correct, which I have no doubt it is, that the conclusions are correct also.

By Mr. THOMPSON:

Q. Assuming an allowance of 250 second-feet by the Government to the Kanawha Valley Power Company, for lockage, at the Marmet and London dams—on each dam—assuming the flow of the river at Kanawha Falls on October 7th and 8th, 1930, to be 800 second-feet—860 second-feet—allowing for the time of travel of the corresponding flow at Radford dam site, October 3rd and 4th, to be 620 second-feet, would you—and that was October 3rd and 4th, would you, if you had control of navigation on the Kanawha River, with the London and Marmet dams in existence, have permitted, for the dates of October 7th and 8th—excuse me—for October 3rd and 4th, a cutting off of the flow of New River at Radford?

By Mr. JACKSON. We object to the question, because that part of the hypothesis or assumption, that the Government reserved 250 second-feet, has no significance; and even stated hypothetically, it calls for the interpretation of the contract, and this is not a proper subject for the cross-examination of an engineering expert. Also because—we object further because it does not say whether or not the wicket dams in Kanawha River below Marmet have been removed, and whether or not Winfield and Gallipolis are in operation.

By Mr. THOMPSON. That is not pertinent in any respect, as counsel well knows. We are assuming conditions only with respect to London and Marmet and the question went to London and Marmet dams.

By the COURT. Read the question.

(The question is read.)

By the COURT. What was it at Kanawha Falls?

By Mr. THOMPSON. It was 860 at Kanawha Falls and 620 at Radford.

By Mr. JACKSON. I would like to add to my objection that the first assumption is entirely based on some supposed contract right, and any assumption along that line would have to be an assumption of the lockage requirements that were on the river, at that time. It does not matter what the contract says.

By the COURT. Wasn't that the same question that you asked this witness or some other witness.

By Mr. JACKSON. No, sir. I asked a question, assuming what the requirements of the locks were. I did not ask him—assuming that there was a contract, but a certain amount for lockage, what would you have done, and what would have been the effect. I did not ask what would be done but I asked the effect. They have, instead of that, asked him assuming some contract. They have asked him, instead of his assuming what the lockage re-

quirements were, they have asked him to assume that there was a certain contract.

By the COURT. He said "assuming" the allowance of 250 second-feet, whether or not by law or in fact—that is the foundation for the question. Assuming the requirement of 250 second-feet for lockage.

By Mr. THOMPSON. No, sir; but assuming an allowance of 250 second-feet for lockage at the two reservoirs.

By Mr. JACKSON. We object, because it should be an assumption of fact or an assumption as to contract rights, one or the other, so that we may know what it is.

By the COURT. Assuming 250 second-feet required for lockage and that the authorities in charge of the Government operations on the Kanawha River proceed on the basis of 250 second-feet—that that is required?

By Mr. THOMPSON. Yes, sir.

By Mr. JACKSON. If your Honor please, I do not wish to be persistent, but the question of whether or not certain water was required, in fact, and the question of whether or not there was some theoretical contract provision for water not needed in fact, would have a bearing on what my course of conduct would be. It seems to me when the question is put in that form and counsel refuses to define it, that it is objectionable.

By the COURT. He may answer it.

To which action of the Court in overruling said objection, counsel for the defendant excepts to the ruling of the Court, for reasons heretofore stated.

A. I understand that there are a great many dates interposed, and some suppositions—I could not quote them fully—but
2571 I understand that you assume essentially that Kanawha Falls was 860—yes, sir—second-feet, on that particular date, and that at a previous date, which would have affected that flow—there was at Radford dam 620 second-feet, and you leave indefinite what, if anything, was coming down New River, except that he expected the 800, on that assumption—that it did affect—or the 860—that involves, as I gather it—if you close the Radford dam under these conditions, you would have 240 second-feet available for navigation purposes.

Q. For lockage?

A. Now, of course, it would depend on two things—as to whether or not that would affect navigation. First, whether or not you would use 240 second-feet, and, in the second place, if you did use more than 240 second-feet, you have storage, as I understand it, at what you call the London dam of 2,700 acre-feet; a three feet draw-down that would supply lockage and

leakage for several days. Apparently, there is very little difference between the water available and the assumption that you made as to the use of 250, if that run along many months—that is many days, still the reservoir above London would take care of the lockage and render it unnecessary to get more water down the river.

By Mr. THOMPSON:

Q. I don't quite get your reply?

A. I might say that you gave several dates, but I think I understand definitely what you ask.

Q. The flow is cut off on the third and 4th. Allowing for the time period for water to travel down the river, which would be the 7th and 8th at Kanawha Falls?

A. You would have 240.

Q. Give it at Kanawha Falls at 860.

A. If you cut off 620, you would have 240?

Q. Yes, sir.

A. Assuming that you use 250, you will have 10 second-
2572 feet shy, unless you take it from the London pool.

Q. Assuming for navigation purposes, that the government—that you have a three-foot draw-down at London dam; assuming that they kept the pool filled to the top, doing so with the three-foot draw-down; what would you say as to the necessity for allowing water to come down from the Radford project?

A. You would have ten second-feet short, if your assumption is correct.

Q. You said something very interesting this morning about the conditions of the Charleston water supply. I think you were the witness who said they got their water supply from the Elk River?

A. I mentioned it; yes, sir.

Q. You made a study of that?

A. I made an examination and report to the Commission, at their request.

Q. As I understand you, water was taken from the Elk River, close to its confluence with the New River?

By Mr. JACKSON:

With the Kanawha.

Q. Yes, sir; the Kanawha River?

A. Yes, sir.

Q. Yes, sir.

A. It was taken, I don't know—a number of hundred feet up the river, I imagine.

Q. And at a time when the Elk River was practically dry?

A. Practically so, yes, sir; it was very little water.

Q. As a result of the flow, the New River—the flow of the New River, had backed up into the Elk River?

A. The Kanawha River?

Q. Yes, sir.

A. The Kanawha River—the flow was reversed in the Elk and the water flowed to supply the water needed by——

Q. What is that?

A. It reversed the flow in the Elk and water flowed from the Kanawha.

2573 Q. Into the Elk?

A. Yes, sir; to supply water needed for the pumps.

Q. So that, under these conditions, there was a pollution, as I understand it, of the water in the City of Charleston?

A. Yes, sir.

Q. Now, if you were in charge of navigation and the protection of riparian owners along the navigable parts of the Kanawha, under the conditions such as I have described about the flow from Radford, and at Kanawha Falls, would you, if you were in charge and had the final say, want to cut off the flow from Radford under those conditions?

By Mr. JACKSON. We object to the question, because it goes to both the question of water supply and to navigation. It cannot possibly and does not have anything to do with water supply.

The objection is overruled and the defendant excepts to the ruling of the Court for reasons stated.

By Mr. THOMPSON:

Q. Assuming what I have told you.

A. I am trying to get them in mind. It is rather complicated. I should certainly want to see that there was enough water for navigation, I expect.

Q. And you would certainly want to know if there was enough water for riparian owners?

A. Yes, sir; I should assume there was a duty there to be attended to, by myself or someone else.

Q. If you were in charge, would you order the flow from Radford to go down the river—the natural flow of the river?

A. I could not conceive myself that the discharge from Radford would not be coming down the river at this time. You assume conditions that I do not believe practical. I do not think it could possibly occur in any reasonable system of operation. The fact that the reservoir is built to store water at high periods and let it out at low periods, would assure that the water would come down the river.

Q. Didn't you say that you could operate this project so as to cut off the Radford project for a period of eight hours at a time?

A. I think I said two days or a year, then said indefinitely, but that was on a supposition that was untenable. You have got to look at the reservoir for use as a practical proposition. If you are going to assure that, as the owner of the reservoir, I am willing to operate it to try to injure somebody, regardless
2574 of my own interests, I assume we could find somebody that would make the water low in time of low water and high in high water, but if I did that, I would lose my interests.

Q. No, sir. I would not expect you to kill or injure somebody, but you would have a self-interest there, which would be perfectly human and natural, and you would want to push that self-interest just as far as you could. That is, without becoming some outlaw or something of that sort, but in dry times, wouldn't you close down in order to get a head of water on Saturday afternoon, when the dam was off and not open until Monday or Tuesday?

A. I should expect in summer time to have 1,200 second-feet capacity.

Q. Yes, sir. But we come back to the question of average. I cannot get that out of my mind. Do you say this average amount you could cut-off for a couple of days at a time, without allowing the water to go down the river?

A. You could shut-down for a day or two at a time, I presume, without any very serious effect. Of course, in the operation of a plant of that kind, I would doubt if that would be done. I think it would operate certainly continuously for five days a week and I think it would operate to some extent at least on Saturday—I should doubt it, although it might be shut-down for Sunday.

Q. Wouldn't it be perfectly natural to do as General Taylor has said in his letter—in his report—to allow for a flow sufficient below there—from the watershed below there, to take care of the needs down the river, and on that theory, to close down in order to store for a head from Saturday to Monday, and on a Holiday, until Tuesday?

A. I think the General's assumptions are entirely untenable, and I could not conceive of the operation of the plant so as to affect rights below. Any operation—intelligent operation of the plant must consider the interests below—the riparian, navigation, and any other interests downstream; the plant would necessarily be operated so as to take care of those interests, or trouble

would result. When you ask about the physical possibili-
2575 ties of doing foolish things, you can do almost anything conceivable on suppositions, if you do not care what happens, but intelligent people try to keep out of trouble, and I believe most people who operate hydroelectric plants have reasonable intelligence and they are particularly anxious to keep out of trouble and operate it intelligently and do not try to seek difficulties. I cannot see that this plant could be operated, or would be operated, in any way but along an intelligent line, that would take care of rights down below, navigation, riparian, and water supplies and all, and the water stored during the high state of flow would be used intelligently to increase the flow, both through the plant and through the river, in low-water conditions.

Q. Well, it might increase the average flow, but how about this interim period, where at times you got below the average flow, and then at times you got above the average flow. In other words, your interpretation of the word "average."

A. The average in a day—I was speaking when I referred to that, as the pretty well ironed-out average between Radford and the Falls. These little waves that occurred would be such that when they got to the Falls, they would be apparently uniform.

Q. You have testified as to the type of wave this company would or could use?

A. No, sir; I did not say as to the wave; no, sir.

Q. Defendant's Exhibit 594—that calls for Zero to 9,000 second-feet?

A. That particular——

Q. In a dry period, such as October 1930 or 1925, if you ran this project on a peak load basis, 9,000 second-feet in 8 hours, you would have to close down for the other 16, would you?

A. I assume so; but I don't think an intelligent use would involve any such use of water; in fact, this particular load curve you are presenting there, is in my judgment an idea of about the average load curve that would be used during the year. It might not be. It might not be at all feasible to use that particu-
lar load curve. It might be a half of that or a quarter of
2576 that, under low-water conditions. I would expect that plant to be run by intelligent people that would use sense and take care of the necessary conditions to preserve their rights and the rights of other people. They have tried to do it in all the plants that I have been associated with, and that is a great many—

Q. The conclusion of your testimony on this point, as I gather it, is that intelligent people would not run it so they would take less, say, or a discharge of 8,000 second-feet for 8 hours a day,

but that would not be done by people who were venal, and careless and selfish, if they saw fit?

A. It could be run in any way you might assume, under those conditions.

Q. Under those conditions.

By Mr. THOMPSON:

Q. You were asked a general statement this morning by counsel as to the flow of the river being indicated at a gaging station at a certain height on a river (let us say on New River—I kind of think that they got down close to New River), and that the flow down below was less than the flow at the point above; do you recall that?

A. Yes; I recall that.

Q. And you answered generally, I believe, that that would indicate that the Geological Survey reports of stream flow, or gaging station reports, had been taken carelessly or incorrectly, or something was wrong with them; is that correct?

A. Essentially; yes.

Q. What, if any, situation did you have in mind on New River with respect to those questions?

A. Well, the material increase in flow on a straight stretch of river, where there was perhaps no tributary, where the upper gages showed a very material increase over the lower gages, in my judgment that just can't happen in this country. It happens very commonly in the west. I have seen flows on the Tucson River coming down from the mountains and absolutely disappear and sink. In this part of the country with your ground water curves towards the river (the water flows towards
2577 the river), and where there is earth and gravel, through those especially, I know of no place around this part of the country, although in certain cavernous regions it might occur, but I know of no place along New River where seepage could take place. Of course, evaporation could take place, but that is a small element.

Q. You do not know the evaporation on New River, do you?

A. No.

Q. Nor the absorption in the river from plants?

A. There is not much absorption in the river from plants.

Q. You draw the conclusions that there must be a mistake by the Geological Survey men who were keeping charge of the gaging stations?

A. I would say a mistake in the reader or the rating of the streams. These rating stations change more or less from time to time, and very frequently you have to establish new ratings.

Sometimes they are off very materially, due sometimes to the filling at the cross section or the gaging station, or sometimes through the digging out, sometimes to obstruction by logs and matters of that kind, so I have found stations very seriously in error—as much as 50 percent.

Q. Were you talking about a supposititious case when this question was put to you by counsel, or did you have some specific case on New River in mind?

A. I had no specific case. I do not know of any personally on New River. I understood the question to have been if there was a very large decrease in flow between upstream and downstream on New River, and what it meant in my judgment, and I would say it would mean an error in one case or both.

Q. There was some testimony to the effect that at Caperton (Caperton is a place, I guess, 18 miles above Kanawha Falls, a stream gaging station), the gaging station records showed a certain flow; then there was testimony that a gaging station down at Kanawha Falls showed a flow that was less, 120 second-feet less, and then there was testimony to the effect that in between

2578 the Caperton gaging station and the Kanawha Falls gaging station there was the power plant of the Glen Ferris project, which is owned by the Electro-Metallurgical Company, and there was a chart produced showing that on the specific day when these two gaging stations records were kept, that at a certain time at Kanawha Falls, at 2 o'clock in the afternoon, there was a sudden cutting off of the flow of that stream that would account for the 100 or 120 second-feet, under such circumstances, would a situation of that kind clear up the problem that you say that you would not say was a mistake in the report of the Geological Survey—and I might add there was no corresponding falling off in the gaging station at Caperton?

A. I understand from your question that you are stating as a fact that the flow was interrupted in some manner and held back?

Q. In an artificial manner, I am assuming?

A. That might be the reason for the fluctuation of gages, and the point I meant to emphasize this morning was that with the stream in normal flow in this part of the country, there would be no materially less discharge at a downstream station than at an upstream station on the same stream.

Q. And that the only way that that could be changed would be by some artificial interruption?

A. Well, that is true.

Q. Isn't it quite possible, Doctor, that you may have a gaging station above a reservoir show a different flow from the gaging station below the reservoir—a greater?

A. Surely the reservoir might store all the water and there might be no water running lower, and it might make a certain amount of reduction in the flow.

Q. Doctor, if the Radford reservoir were not full and the flow in it were 9,000 second-feet, or even somewhat more, is it not reasonable to assume that the Radford plant might be operating on a peak load?

A. That depends on the demands of the system, I expect. It might be operating on the peak load at some time in a day.

2579 Q. If 9,000 second-feet were coming in, and you had the capacity for 9,000 second-feet discharge, isn't it reasonable to suppose, if you were on a load demand of that kind, that you would put it on peak?

A. I should think under those conditions that what you would do would be to bring the plant up to its capacity and operate it uniformly thru the day at 9,000. That would be the purpose of the plant and of the reservoir. Does that answer your inquiry?

By Mr. THOMPSON:

Q. I will ask you this question, Doctor: If the Radford reservoir were not full, and the inflow to Radford was equal to 9,000 second-feet, is it not quite likely that the plant would be operated so as to peak a portion of the inflow, using the remainder to replenish the reservoir?

A. I should think if there was not a demand for the power, they would necessarily save the water in the reservoir, and I do not see how they could peak 9,000 second-feet when 9,000 second-feet, as I understand, is the total capacity of the plant.

Q. The question here was the peaking of a portion of the inflow, using the remainder to replenish the reservoir?

A. I do not quite recognize the language you use. I think you might use a certain amount at the rate of the 9,000 second-feet and operate other times during the day at less, allowing the difference to stay in the reservoir.

Redirect examination by Mr. JACKSON:

Q. Dr. Mead, assuming a hydraulic capacity of the power installation at the Bluestone reservoir to be 11,000 second-feet; is there any reason why any flow into the Bluestone reservoir not exceeding 11,000 second-feet should not be reregulated in the operation of the Bluestone power station?

A. I think it would be entirely controlled, reregulated or utilized or whatever you might call it, by the Bluestone plant.

Q. In connection with your cross-examination on gage errors in U. S. Geological Survey, I think you said, and said on
2580 your direct, that in your judgment the factor of error in recent estimates of stream flow would be on the order of 5%. Will you state whether or not you there refer to the average or possible errors in individual measurements or estimates?

A. The general average estimate of about how those things stand, in my judgment, as a whole; individually they may be very large errors. There are very large errors at times. I have found them.

Q. Can you give some indication of the errors of individual estimates?

A. They run from very small factors up to sometimes 50%.

Q. You also testified to the fact that the same gage readings at a particular gaging station on the same stream may relate to different flows depending upon whether the gage represents a condition of steady flow, rising flow or falling flow. Will you state what is the order of variation which results from those three different conditions at a gaging station?

A. Well I should think there might be an order of, I am naming now an extreme of course, of possibly 15% or 20%, usually less.

Q. You were cross-examined somewhat about the matter of the water supply at Charleston. Will you please state whether or not the taking of the water supply of a city from the same stream to which the effluent is returned substantially decreases the volume of flow below the point of return?

A. No; it does not. The average sewage of a city is pretty close to its water supply. That is the usual basis except where storm water is taken in and the sewage may be greater.

Q. The effluent and pumpage are practically equivalent?

A. Usually, but exceptions. Sometimes the sewers leak and it is increased, and sometimes the leakage is in and sometimes out, may be increased or decreased. A great many conditions arise.

2581 F. W. SCHEIDENHELM

Direct examination by Mr. JACKSON:

Q. Please state your full name and residence for the record.

A. F. W. Scheidenhelm, New York City.

Q. What is your occupation?

A. I am an Engineer, Consulting Hydraulic Engineer.

Q. Where do you practice?

A. New York.

Q. What has been your education?

A. Aside from an ordinary secondary school education, I attended college at Cornell University, completing the course for the degree of A. B. which I received in the year 1905, and the course for the degree of Civil Engineer, which I received in the year 1906.

Q. What has been your experience in the practice of your profession?

A. If I am to give that in detail I shall need some notes which I do not have before me.

A. (Continuing after securing notes.) After graduation from the Cornell University in 1906, and after several summers of practical work of one kind and another, I became in the summer of 1906 Structural Engineer with West Penn Railways Company, and beginning in 1907 was placed in charge of its Structural Department. At that time I installed a 6,000 KW additional capacity in its main steam-electric plant at Connellsville, Pa., which amount seemed large in those days, and was relatively larger than it is in these days. I had charge of design and construction of additional boilerhouse, condensing-water system, coal-conveying system, etc. Also, as Structural Engineer, I designed and constructed certain reinforced-concrete bridges and transmission towers.

I reported on various hydroelectric projects and dams for American Water Works & Guarantee Company.

1909 and continuing to 1911, I was in independent engineering practice, with headquarters at Connellsville, Pa. I acted
2582 as Chief Engineer of Pittsburgh Hydro-Electric Company; Consulting Engineer for Union Utilities Company of Morgantown, W. Va.; and as Chief Engineer of Georgia-Carolina Power Company. I made miscellaneous investigations on steam power, water supply, and hydroelectric projects.

From 1911 to 1914 I was Chief Engineer of Hydro-Electric Company of West Virginia and West Virginia Development Company, Pittsburgh, Pa. During that period, namely, from 1913 to 1914 I was also Vice President of Hydro-Electric Company of West Virginia.

1914 to 1915 I was Consulting Engineer at Pittsburgh, Pa. During that period I took a trip to the far west, which was a combination of business, pleasure and professional education. I visited thirty-four hydroelectric developments west of the Mississippi River.

1916 to 1917 I was in New York City, having gone there in early 1916 and became associated as the New York associate of Daniel W. Mead and F. W. Scheidenhelm, engaged in Hydraulic practice. Also, I was interested in an officer of the Scheidenhelm

Construction Corporation, engaged in certain construction in the vicinity of New York and in Connecticut.

From May 1917 to August 1919, I was in the Military service. After having received some degree of Military education I went to France. In due course I commanded the 26th Engineers and attached troops in charge of Water Supply of the American First Army front, during St. Mihiel and Meuse-Argonne offensives, and did various other things and came back to the United States.

From 1919 to date I have continued in the Consulting Engineering practice in New York practicing in water-power matters in association with Dr. Mead.

I have had direct responsibility as to detailed design and construction as follows:

Exploration and design of 20,000 HP development on Savannah River, Georgia, for Georgia-Carolina Power Company; 30 ft. by 2,500 ft. dam with locks. I carried that through the stage of securing approval of plans from the War Department in 1910 to 1911.

I was in charge of exploration, design, and partial con-
2583 struction of State Line or Lake Lynn development, Cheat River, West Virginia (1911–1914), for the Hydro-Electric Company of West Virginia, a part of the so-called West Penn power system. That involved a dam 85 ft. by 1,100 ft. and installation of 48,000 H. P.; and an expenditure of $1,500,000 prior to the financial failure of the controlling financial interests, due to controlling Western irrigation projects. Later, in 1920, and continuing through 1925, I was Consultant to the reorganized interests under American Water Works and Electric Company, until the State Line dam on Cheat River was completed in somewhat larger form, so far as concerns capacity.

I was in charge of the exploration, design and partial construction of the Big Sandy Creek development in Pennsylvania and West Virginia in 1911 to 1914, for the Hydro-Electric Company of West Virginia. The dam there reached only its preliminary stages. It was to have been 200 feet high, to have involved a 3½-mile tunnel, a 600 foot head and 50,000 HP of installation.

The Lake Lynn installation, by the way, was finally made to a total of 70,000 HP. I was in error in stating its completion was in 1925. It was completed in 1926.

Some years earlier, 1914 to 1915, I had charge of the repair and reconstruction of the Stony River Dam, West Virginia, for the West Virginia Pulp and Paper Company. That dam had failed in 1914. There I had complete responsibility for the design and supervision for the reconstruction.

I reported, or acted as Consultant for banking houses, power companies, municipalities, etc., on various hydroelectric projects, during the period 1910 to 1933. This list includes the following, beside those which I have heretofore mentioned:

The Auglaize River, Ohio, 8,000 HP.

Blackwater River, West Virginia, 44,000 HP., and a total head of 1,400 feet, practically the highest, if not the highest project east of the Rocky Mountains. By highest project I mean highest head. Later it has been proposed to cut that development into two stages.

Fall Creek, New York, 15,000 HP.

A development on Shavers Fork, West Virginia.

2584 On Mongaup River, New York, of 28,000 HP. development.

Another on Neversink Creek, New York.

The development of the Province of New Brunswick Development on Musquash River, Canada, a report for the City of St. John, 10,000 HP.

An investigation and report on the dam of the Arkansas Light and Power Company, on the Cauchita River, Arkansas.

An investigation and preparation of preliminary plans for a development since constructed by ——— Power Company, Riviere des Prairies, Quebec, Canada, 120,000 HP.

An extended study on a series of projects on Cheat River in northern West Virginia, and to a minor extent in Pennsylvania. The total capacity of the series being approximately 700,000 HP.

As to the Oswego River, New York, a report for the City of Oswego on economics of utilization of the water power on that river, 7,500 HP.

The North Fork of the Kentucky River in Kentucky, 53,000 HP.

Tributaries of Craig Creek, near New Castle, Virginia, 7,500 HP., the result of that being an adverse report.

Smith Mountain project on Roanoke River, Virginia, 36,000 HP.

Talleys Falls project on Roanoke River, 30,000 HP. That is likewise in Virginia and near the North Carolina line.

A combination, hydro and pumping project near Steubenville, Ohio, 70,000 HP.

A so-called Little Tunnel project on James River, near Buchanan, Virginia, 16,000 HP.

A similar combination hydro and pumping project near Philo, Ohio, in the same amount.

Watauga River projects, North Carolina, 54,000 HP.

Table Rock project on White River, Missouri-Arkansas, the dam site and reservoir only being under consideration by me, 20,000 HP.

The Greenville development of the Tennessee Eastern Electric Company, on Nolichucky River, Tennessee, which was a problem of a sick dam.

The Passaic River, N. J., where I acted as expert in be-
2585 half of Passaic Valley Water Commission, representing three municipalities in proceedings for condemnation of Passaic Consolidated Water Company.

2586 In more recent years, that is, since 1925, beside an extensive contact with projects on the New and Kanawha Rivers, I had charge of the reconstruction, involving rearrangement and enlargement of the Reusens hydroelectric development on the James River, near Lynchburg, Virginia, with a total installation of about 17,000 HP.

Also, since that period I have served as Consultant to the Public Service Commission of New York on appraisals of about ten water-power sites or construction developments in New York State.

More recently I served as a member of the Board of Consulting Engineers on Norris Dam of the Tennessee Valley Authority of the United States.

Q. Have you made any special studies, or had any special experience in the matter of stream flows?

A. I have necessarily, as a Hydraulic Engineer, dealing with water power, had to do extensively with stream-flow measurements, estimates, and of course the practical use of stream flow. In earlier years I undertook various work which required stream-flow measurements, many of which were, the results of which, were published by the U. S. Geological Survey, through its Water Resources branch, and likewise made current meter measurements myself in behalf of the Survey.

Q. Are you familiar with the field of hydrology?

A. In reservoir work and dam construction the fields of hydrology and hydraulics and geology intertwine to a considerable extent. Hydrological problems have come up for attention from time to time largely in connection with the possibilities of leakage from reservoirs, leakage possibilities from stream-beds, leakage possibilities at dam sites. I made an extensive investigation as to the possibilities of leakage of a reservoir site in northern West Virginia in a limestone country. I have
2587 investigated a similar problem in Tennessee, and in connection with the Radford project, which is the subject of this case; conducted a series of investigations extending over a

period of several years and costing at least a quarter of a million dollars, all having to do with the problem of hydrology.

Q. Are you a member of any professional or technical society?

A. I am a member of the American Institute of Consulting Engineers, American Society of Civil Engineers and Fellow, The American Association for the Advancement of Science.

Q. Are you registered as a professional engineer in any of the states?

A. I am, in New York, Virginia, and West Virginia at least.

Q. Col. Scheidenhelm, are you acquainted with New River?

A. I am.

Q. Will you state when your acquaintance with New River began and the occasion for such acquaintanceship as you have of New River?

A. My first professional contact with New River or anything in regard to it, for which I had responsibility, was in 1925; but I recall that in 1913 and for several years later I had knowledge of New River and possible developments on New River, but in a way for which I had no responsibility. In 1925 Daniel W. Mead and F. W. Scheidenhelm were engaged as Consultants by American Gas and Electric Company, in behalf of Appalachian Electric Power Company and other subsidiary corporations operating the power system which is interconnected and extends from approximately Lynchburg, Virginia, on the east to close to Chicago on the west.

Q. With what portions of New River are you familiar?

A. I have not personally been farther upstream than approximately Boyer's Ferry, which is up toward the North Carolina Line, although I have had various investigations and inspections made under my direction still farther upstream. From Boyer's Ferry down to the Byllesby development of Appalachian Electric Power Company I am not familiar, by reason of many inspections, but from the site of the Bullesby development
2588 down to the mouth of the river I think it is fair to say that I am quite familiar with the stream. I have not visited every bit of it, but the parts I have not visited are very limited in extent.

Q. I produce a chart, which bears the legend, "Profile of New and Kanawha Rivers from Forks of New River in North Carolina to Ohio River, showing existing and proposed power developments" and ask to have it marked "Defendant's Exhibit #600 for identification."

2589 Examined by Mr. JACKSON:

Q. Colonel, I show you copy of the chart which was marked "Defendant's Exhibit 600" for identification, just before

the adjournment of last evening. Please state what the exhibit 600 for identification is? I do not mean to tell what it shows, but just what it is?

A. It is a profile of New and Kanawha Rivers from the forks of New River in North Carolina to the Ohio River, showing existing and proposed power developments.

Q. Was that chart, Exhibit 600 for identification, prepared by you or under your direction?

A. It was prepared under my direction.

Q. And does it accurately portray what it purports to show?

A. It portrays it with what I believe is reasonable accuracy. I would not say there is not a minor mistake, but I accept it as accurate.

Mr. JACKSON. We offer it in evidence, Exhibit 600 for identification.

Mr. THOMPSON. May I ask if it purports to show the railroad and the correct distances from the bank of the river?

WITNESS. The only way in which it would show that would be in elevation, and I think it is approximately correct in that respect.

By Mr. JACKSON:

Q. Now, please state what is shown with respect to New River by the profile marked "Exhibit No. 600"?

A. It shows the profile of the river at a water condition which probably is about ordinary water level. It is not possible, on such a scale, nor was any attempt made to show any particular stage of the river, although certainly it is not a flood stage on the river.

In addition, there are shown certain paralleling railroad lines, likewise shown in elevation, because it is a profile, and
2590 there are shown varying existing and proposed navigation and power developments between the mouth of Kanawha River and the junction of the North and South Forks of the New River in North Carolina.

Also it indicates the ownership of the various power developments existing and proposed which, in elevation, are depicted on profile.

Q. Where is the Radford development?

A. The Radford development is near the right-hand end of the profile. The horizontal scale of the profile is in miles measured from the mouth of Kanawha River, and the site of the Radford development, according to that scale, in miles is at approximately mile 252. It is marked "Radford development" on the profile.

And where are the Buck and Byllesby developments with
ence to Radford, as shown on Exhibit 600?
The Buck and Byllesby developments are the next develop-
s in an upstream direction, and the Buck development is
ed "No. 4, Buck," at about mile 297. That development
named after Harold W. Buck, who has testified in this case.
e Byllesby development is about mile 300. That is also
n as New River Development No. 2. The numbers are those
ppalachian Power Company and subsequently Appalachian
ric Power Company.
that same series of numbers, the Radford development is on
ion known as New River Development No. 6.
Is there shown "New River Development No. 1"?
Just upstream from the Byllesby development is a develop-
"New River No. 1," and between Byllesby and Buck devel-
nts is a site on New River "Development No. 3."

By Mr. THOMPSON:

Could you tell us on No. 1, is that owned by some-
body?

By Mr. JACKSON. I was going to ask whose proposed de-
velopments are these.

As shown by the chart, which is according to the legend,
sites are owned by the Appalachian Electric Power Com-
They are developments which had been proposed by its
cessor, Appalachian Power Company.

By Mr. JACKSON:

Further to the right on Exhibit 600 are certain projects
nated, respectively, Boiler project and Osborne Falls project;
are they?
If counsel doesn't mind, to complete the story in an up-
n direction, there is another existing development on New
just upstream from the site of the Appalachian Develop-
No. 1. That existing development is at Fries, Virginia, at
mile 308. It is owned by Washington Mills, I believe.
en still further upstream, at about mile 321, is the Boyer
ct of Appalachian Electric Power Company, and still fur-
upstream, at about mile 343, is the Osborne Falls project
e same company. Those two projects are at storage reservoir
cts, with which there would be combined some degree of
r development, but they may appropriately be described as
vater storage projects.
Have you now described all the projects upstream from the
ord development, as shown on Exhibit 600?
I have.

Q. Will you now describe the projects on New River downstream from the Radford project, as shown on Exhibit 600?

A. Between the site of the Radford project and approximately Glen Lyn, Virginia, there is no proposed water power development, so far as I know—at least none proposed at the present time except so far as concerns minor mention in the 308 report on the Kanawha River.

2592 On the profile is shown the Bluestone power project of West Virginia Power Company, a subsidiary of Appalachian Electric Power Company. That project extends from about mile 163½ to a point just below Narrows, Virginia. It consists of a two-stage development, the stages being known as Hinton development and Bull Falls development, respectively. The site of the Hinton development is about mile 163½, involving a low dam for a reregulating reservoir.

The site of the Bull Falls development is at about mile 172 at Bull Falls on New River. That is a high dam, intended for storage and power development.

Continuing down the river from the site of the Bluestone development past Hinton, there is shown Sandstone Falls, otherwise known as Richmond Falls, a development of an indirect type, proposed to be made by Electro-Metallurgical Company, which is identified as subsidiary or otherwise with the Union Carbide & Carbon Company. That development is in prospect.

Nearer the junction of the New and Gauley Rivers, and, specifically, at about mile 105, is the site of the dam of the Hawks Nest development of the same Electro-Metallurgical Company. That is a large development now in existence and in operation. It is of the indirect type. That is, the water is taken out at a diverting dam through headgates, and is carried through a tunnel for a distance of three or four miles to a power station at about mile 98.

Although the tunnel is three or four miles long, the distance by river is five or six miles, and, therefore, the tunnel length as shown on the profile has had to be stretched out, and it is shown dotted. That is because the profile is along the river and not along the line of the tunnel.

The tail water from the Hawks Nest power station empties practically into the headwater of the Kanawha Falls de-

2593 velopment of the same Electro-Metallurgical Company. That is a relatively small development. It was made about 1901, I believe.

Q. Is that sometimes called the Glen Ferris development?

A. It is.

Q. Have you completed your description of the projects on he New River, as shown on Exhibit 600?

A. I have, and I have gone into Kanawha River to the extent f the Kanawha Falls development.

Q. Are you familiar with the Kanawha River?

A. I am.

Q. To what extent?

A. I have traversed it from its mouth to its head, and have ad occasion to spend considerable time at various special places long the Kanawha River.

Q. Referring to Exhibit 600, please explain what is shown ith reference to navigation and power developments existing or roposed on the Kanawha River?

A. In making this profile one was faced with the difficulty f attempting to show what would be in existence in the future nd what is in existence now, and on the Kanawha River portion f the profile there is an attempt to show both the conditions of he near future and likewise the existing conditions.

If one goes back two or three years in point of time, one will nd that the conditions on the Kanawha River involved ten low avigation dams, the two up-streams being of the fixed type and he eight downstream of the wicket type. In the meantime, the pstream four of those dams have been displaced. They are umbered 2 to 5, inclusive. There never was a No. 1.

In the lower left-hand portion of the profile, rather faintly, are hown the locations of the existing dams, Nos. 6 to 11, inclusive, nd likewise the nominal pool elevations of each of those six ams.

The upstream four dams which were displaced, were dis-placed——

594 Mr. THOMPSON. Excuse me. Have you got any more of those maps?

Mr. JACKSON. The photostat does not show very clearly, I hink, Mr. Thompson.

WITNESS. The profile shows nothing on the Ohio.

By Mr. THOMPSON:

Q. Is there any indication of wicket dams on the Kanawha?

A. Yes; there is on the photostat, I think, of the same profile. is very faint. The notations seem clearer on the original hart. They are below the profile of the river itself, and there an arrow pointing upward.

Q. It is very faint?

A. The locations of the respective dams can be seen by an rrow pointing up to each site.

Q. There are five of those arrows?

A. I can count six.

Continuing then, the four upstream navigation dams of the old type have been displaced by two high dams of the roller-gate type. The upstream of these two dams is the London Dam, and, under the new system of numbering of the U. S. Engineer Department, is No. 3. The next in the downstream order is the Marmet Dam, and under the new system of numbering, that is No. 2. Each of those dams has a power development, constructed and operated by the Kanawha Valley Power Company, a sister company of the Appalachian Electric Power Company. These stations are operated under license from the Federal Power Commission.

Still further downstream, at about mile 30½, is the site of the Winfield navigation dam of the United States, under construction. The dam, which will have its pool elevation at 566 feet above mean sea level, will drown out the sites of the three existing and wicket-type dams numbers 6 to 8.

Q. Inclusive?

A. Inclusive.

2595 At the site of the Winfield dam, there is likewise under construction a power development by the same Kanawha Valley Power Company, similarly under license from the Federal Power Commission. It is being constructed and will be operated under a different license than that which controls the construction and operation of the London and Marmet developments. The London and Marmet developments are known together as the Kanawha project.

The Winfield development, upon the records of the company and presumably the Federal Power Commission, is known as the Winfield Project.

Still further downstream is shown the head of backwater of the Gallipolis dam now being constructed on the Ohio River by the United States. That dam will backwater up the Kanawha River to the foot of the Winfield dam, and, when completed, will drown out the sites of existing and old navigation dams numbers 9, 10, and 11.

The navigation project of the United States for and in connection with these new high dams is a nine-foot project. The former project and that which is still in operation in respect to pools Nos. 6 to 11, inclusive, is a six-foot project.

By Mr. JACKSON:

Q. Col. Scheidenhelm, you just testified that prior to the recent improvements on the Kanawha River, there were ten old

gation dams, of which Dam No. 2 was the furthest upstream; right about that?

. Yes.

. What was the distance between the Radford dam site and old No. 2 dam?

. A. t 160 miles; perhaps a little nearer 163 miles.

. I think in your qualification you stated you have been sulting Engineer for the Appalachian Power Company and its affiliates since 1925?

A. That is correct.

Q. Will you please state what has been your connection the power developments of the Appalachian Electric Power pany and its affiliates on New River and the Kanawha River?

.. Perhaps the most convenient way of making that state- it would be to use the profile of Exhibit 600, and to begin the Kanawha River. That is at the lower left-hand end he chart.

By the COURT:

. Col. Scheidenhelm, the plaintiff introduced here Exhibit 119, and purports to show the proposed improvements along Kanawha River. On that I notice set forth what they call Whitethorne project, a proposed project, it looks like about miles below Radford and Monkey Shoals. That is not shown your map.

.. That is one of the projects which I have referred to as be- included in the so-called 308 report of the United States gineering Department upon Kanawha River, which report is, elieve, Exhibit 145 in this case.

. Is the same true then of what is known as Barren Springs ject?

.. Yes. There are others, undoubtedly. For instance, there headwater project set forth in that report known, I believe, Moore's Ferry project, with its site somewhere in the vicinity Boyer's Ferry. It is not there because it is in the neighbor- d of Moore's Ferry. It is not exactly there, but in that vi- ty. The Moore's project and the Boy r and Osborne projects the Appalachian Electric Power Company could not both t at the same time. There are undoubtedly other projects set h in that report. So far as I know, they are not authorized jects.

. Your diagram of that section of the river shows what you designate as the Bull Falls project; right below is reregu- lating dam. That section of the river is comprised within the Bluestone project, isn't it?

A. Well, one needs to keep clear which Bluestone project one speaks about. On this chart there is a project which is labeled "Bluestone Project;" that means the Bluestone power project of the Appalachian Electric Power Company.

Q. What I am getting at is this: You have designated here Bull Falls development, and immediately below it is "Hinton development," which, according to the legend, is "proposed power development of West Virginia Power Company." Those developments cannot be made under existing conditions, can they? I mean, isn't that portion of the river there being developed under the Bluestone project, which has been referred to throughout this case, a storage dam proposition of the Federal Government?

A. I was about to say that that same scope, from the Hinton dam site to the headquarters about Narrows, is comprised in the Bluestone reservoir project, which has been recommended by the Chief of Engineers and Secretary of War.

By Mr. THOMPSON. May I ask a question for my information at this time? Is this Exhibit #600—does it show so far as New River is concerned, only the projects which are constructed or proposed to be constructed by the Appalachian Electric Power Company?

By the WITNESS. As distinguished from what?

By Mr. THOMPSON. As from those proposed by the Government.

2598 By the WITNESS. That is correct so far as projects other than navigation projects are concerned.

By Mr. JACKSON. You refer to navigation projects on Kanawha River?

By the WITNESS. It is my understanding it is true on both the New and Kanawha Rivers.

Q. Will you proceed with your statement?

A. Beginning then at the lower end of the Kanawha River, in the case of the Winfield project of Kanawha Valley Power Company, I had a consulting relationship to it from its very conception, so far as concerns the power company, and continuing that relationship the general plans of the project were prepared under my direction. I conducted the negotiations between the Power Company and the Federal Power Commission, and likewise with the U. S. Engineer Department, so far as concerned certain navigation aspects of the matter, my relationship being with regard to all engineering matters involved. The construction is being carried on with such benefit as there may be under my consulting advice.

Proceeding upstream the relationships in respect to the London and Marmet Power developments were of the same order.

The London and Marmet dams were proposed in somewhat different form and under different names originally, by the U. S. Engineer Department. They had the names of "Pratt" and "Burning Springs" respectively, though I do not recall now which pertained to the London navigation project.

Various schemes of power development were proposed until finally the navigation project took definite form as set forth in a House Document, which I believe is an exhibit in this case, although I am not positive of that.

The negotiations were likewise conducted, so far as the engineering and economic aspects were concerned, under my
2599 general direction, and the general plans were so prepared.

The projects went to construction early in 1934, and because of the fact the Chief Engineer of Kanawha Valley Power Company was temporarily incapacitated by an accident, I acted as supervising engineer for several months in the case of the construction of the London and Marmet developments. I likewise am consulted in all important matters of operation insofar as affects any relationships with the navigation on the Kanawha River and in that connection with the U. S. Engineer Department.

Coming now to the New River and that portion between the Hawks Nest development and the Sandstone Falls development, there is a stretch of river which has a total fall of about 460 feet, and which occurs opposite [interrupted].

By Mr. THOMPSON. Where is that?

By the WITNESS. As I stated, between the Hawks Nest Development and the foot of the Sandstone Falls project.

A. (Continuing.) Throughout that area the riparian rights are owned largely as between Appalachian Electric Power Company and its affiliates, and Electro Metallurgical Company and its affiliates. I advised throughout the purchasing of those riparian rights by the Appalachian Power Company and its affiliates.

Q. Let me ask you at that point, what is the difference, if any, between the power market served by the Electro Metallurgical Company plants and the market served by the defendants?

A. The Electro Metallurgical Company supplies its own industries, and those of affiliated companies. Those industries are electrochemical or electrometallurgical, and in consequence thereof they have a relatively uniform load. On the other hand, the Appalachian Electric Power Company market is the ordinary public utility market, with a varying load; that is, it varies from time to time throughout twenty-four hours and over longer periods.

2600 Q. Will you continue with your statement with regard to these proposed projects upstream on New River?

A. As regards that stretch of river between the headwater of the Hawks Nest development and Sandstone Falls, the kind of power developments contemplated there, so far as the Appalachian Company and affiliates are concerned, will be of the indirect type. That is, they would be of the type like the Hawks Nest development, with low dams for purposes of diversion and pondage, and connected with tunnels which would have a length substantially shorter than the stretches of river between the diversion dam and the power station. Within that stretch of river the 308 Report of the Chief of Engineers refers to a series of low head developments, which of course are not shown upon this Chart, Exhibit #600, nor so far as I am aware are they shown on any published Governmental chart or map, and they are not referred to in any detail in the 308 Report.

Continuing them up New River, beyond the mouth of the Greenbrier to the Bluestone power project, West Virginia Power Company, I became familiar with that project probably about 1926. At that time it consisted of a single high dam at the site of the so-called Hinton development. That site is owned by West Virginia Po er Company, as are approximately one-fourth of the lands involved in the power area. One might call it between the Hinton dam site and a point well up toward Narrows, Virginia.

By Mr. THOMPSON. You said one-fourth of the land?

By the WITNESS. Approximately. I do not know the precise amount.

A. (Continuing.) After studying that project it was changed under my advice into the form set forth in the chart. I had to do with the application to the Public Service Commission
2601 of West Virginia for a license for that project, and have acted as engineering advisor throughout the history of the project since I first became identified with it about 1926.

Then continuing upstream one comes to the Radford project, or, as styled on this chart, "Radford Development". From 1925 until the present time I have had a Consulting Engineering relationship to that project.

Still farther upstream at the Buck and Byllesby developments I of course had nothing to do with the construction of those projects, they were built about 1911–1912; however, I have had to do with various repair work which proved necessary at the dams, and in the power stations.

Q. What, if any, engineering connection have you had with the Boyer's project and Osborne Falls project?

A. Both of those projects were laid out in my office, and I have, I believe, advised with regard to the acquisition of some of the lands with regard to those projects.

2602 Q. Colonel Scheidenhelm just state briefly the history of the Radford project.

A. The Radford project grew out of a plan of development proposed perhaps twenty-five years ago, by Appalachian Electric Power Company, under the studies and with the advice of Veilie, Blackwell and Buck.

Q. Is that Appalachian Electric Power Company or its predecessor?

A. I meant to refer to Appalachian Power Company, the predecessor of Appalachian Electric Power Company. There was a #5 development originally in mind, but, as stated by Mr. Buck, that was merged with the #6 development, and it now goes under the name of #6 development. When I became identified with the project, about 1925, the dam was proposed to be built at a dam site "A" and it was with reference to that dam site a Declaration of Intention was made, about June 25, 1925, to the Federal Power Commission. Subsequent studies of the dam site and reservoir caused me to recommend to the Power Company that the dam be constructed not at dam site "A" but at a site about one-fourth or three-eights of a mile downstream. Such downstream site is the site at which construction is now being carried on. It is the site in respect of which the amended plans were filed with the Federal Power Commission, and were approved by the Chief of Engineers and the Secretary of War.

Q. Are those what are described as the revised plans in Government Exhibit 90-A, if you remember?

A. Yes, sir.

Q. Had you finished your statement?

A. I believe so.

Q. Between the time of the filing of the Declaration of Intention and the filing of the revised plans shown on Government Exhibit 90-A, were there any substantial changes made in the project?

A. Yes. Besides the shift in dam site, the height of the dam, or at least of the headwater level, was changed from about elevation 1840 above mean sea level to 1846. Likewise the

2603 design of the dam was changed substantially from its original form. As indicated at the time the Declaration of Intention was filed it was to be a dam with a long ungated spillway, and there were to have been flood gates at the left bank. In the revised plans the spillway was lowered somewhat and the plan involves the surmounting of that crest with a series of high sliding gates over the entire length of the spillway.

Q. What change, if any, was made with regard to the utilizable storage capacity?

A. The utilizable storage capacity was changed from about 40,000 acre feet to approximately 100,000 acre feet. That was accomplished in part by reason of the increase in height of water level or pool level, and in part by the lowering of the intakes or the pen stocks for the power station.

Q. What change, if any, was made in the capacity of the machinery proposed to be installed?

A. The capacity of the machinery installation as originally proposed was, as I recall it, 60,000 KW. It is now to be 75,000 KW., or in terms of hydraulic turbine capacity in rated form about 104,000 HP. That change was due in part to the increased head, in part to the increased available storage, and in part to the plans which had been made in the meantime for headwater storage.

Q. What is the significance of the plans made in the meantime for headwater storage?

A. The headwater storage would provide more water during the low water season and result incidentally in increased total energy output, because it would to some extent prevent the waste of flood water.

Q. What will be the capacity of the installed machinery in terms of water discharge at best efficiency?

A. Approximately 9,000 second feet.

Q. Colonel Scheidenhelm, are you acquainted with the power system of the defendant?

A. I am generally familiar with it, although not in ultimate detail, because it is a tremendously far flung system.

Q. Does your familiarity extend to the steam generat-
2604 ing stations and hydro-electric generating stations?

A. It does.

Q. Have you any familiarity with the market demands and load requirements of the Appalachian Electric Power Company system?

A. I have a general familiarity with that.

Q. Colonel Scheidenhelm, please state some of the elements of value of a hydroelectric project, such as the Radford project, to a large power system like that of the defendant.

A. There are various elements of value. One of them is what we call installed capacity value, that is the ability so far as machinery is concerned, and of water, to operate that machinery for the purpose of producing energy. That is distinct from the amount of energy that is turned out by that machinery. It is distinct from the work performed by that machinery. In the

first element of value I have intended to include the regular normal utilization of that capacity as distinguished from emergency capacity.

Q. Is that reliable power producing capacity which you refer to or not?

A. In the main that is reliable power producing capacity, although if one takes the Radford project as an illustration, there is only a part of the total installed capacity that would be classed as reliable, and the remainder is available only from time to time for the purpose of turning out energy, or for the purpose of the second element of value.

That second element of value is the emergency use of the capacity for relatively short times when an emergency arises somewhere throughout the system. For illustration, emergency might arise by reason of lightning troubles which separate transmission lines, and thereby cut off a source of supply, power supply, for a portion of the system which has been receiving its supply from beyond the point where the trouble occurs. Under those circumstances it may be necessary suddenly and as nearly instantaneously as possible, to bring into play a new source of power supply. A hydroelectric power station is peculiarly adapted to come into play quickly.

Another illustration of sudden emergency might be an accident to a steam power plant, or conceivably equipment in
2605 a hydro-electric station somewhere else. That is, even large power systems do have their troubles, although it is bound to minimize them.

Now a hydro-electric power station like the Radford power station having its water directly at the power station, so there is not involved any time element of getting water started from pond to power station, is exceptionally well adapted for emergency. The time over which such emergency use extends is relatively short. It may be from a few minutes to, I would say, at most an hour and a half. Ordinarily it would be only one-half hour before other sources of power supply would be brought into play.

A third element of value consists of the work done by the power station. Expressed in another way it represents the energy which would otherwise have to be turned out by power plants elsewhere upon the system, and if such energy were turned out at steam electric power stations coal would have to be burned. I am not emphasizing the burning of coal as the measuring stick of the value, although it is true that in this region steam electric plants are essentially the measuring stick of value of hydro-electric plants, but rather I am referring to coal as representing

the routine consumption of something representing energy or work.

The fourth element of value is existent with various hydro-electric projects, including the Radford project, and that is the benefit to downstream power stations of the same system by contributing stored water to those stations.

The fifth element of value is the ability of the station to operate without water, but in order to carry the ineffective portions of current developed throughout the system. Ordinarily we refer to it as wattless current. That is a relatively minor aspect of value.

There may be other elements of value which are relatively minor and which I have not enumerated.

By Mr. THOMPSON:

Q. I don't believe I follow you on that. Could you give that in a layman's language? You said wattless, did you not?

By the WITNESS. I did.

By Mr. THOMPSON:

Q. Would you explain that a little more?

By the WITNESS:

2606 That is related to what electrical engineers refer to as power factor. It has to do with the relation between the effective portion of energy which is produced, and the total produced in terms of kilovolt amperes. In a system like Appalachian Electric Power Company approximately 10% is ineffective. Now that ineffective current utilizes copper space in the generating equipment and in the transmission lines. It must be disposed of somewhere in the system. Sometimes it is taken far off by what is known as synchronous condensers, but it can be accomplished also within various power stations. I am not familiar in ultimate detail with that particular aspect of the hydro-electric business, because I do not claim to be, and am not as familiar with that particular aspect of a very broad field as I would like to be.

It is pertinent to state I think that a hydroelectric power station cannot simultaneously perform the functions of turning out effective energy to the maximum extent of its generators and at the same time absorb wattless current.

Q. In a power system like that of the defendant, is it necessary that any given generating station carry a specific portion of the system load.

A. It is not. The allocations of load throughout that system are dependent upon a great number of factors, which factors change from time to time. Steam plants and hydro-electric plants

are used alternatively in various portions of the load, depending on conditions as they exist from time to time.

Q. Can you indicate some of the considerations which influence the part of the load which may be carried by particular generating stations; that is, what are the character of those considerations?

A. The considerations involved are the relative economics of operation of individual power stations or individual units within power stations. In the case of hydroelectric stations they involve the available water supply, both natural and that available from storage.

In general, variable portions of the load would be carried by hydroelectric stations, and in general the lower or non-variable portions of the load would be carried by highly efficient
2607 steam-electric power stations. The latter is generally not subject to much exception. The former is. By that I mean the allocation of hydroelectric capacity to the variable portions of a system load, is subject to change, particularly when there are higher flows available, for that hydro-electric station can operate more continuously and can and must do so in order to avoid waste.

Q. In the practical operation of hydroelectric generating stations are there any considerations other than those of economics of operation and distribution of system load that play any part?

A. There most certainly are.

Q. Generally indicate their character?

A. Such considerations, as in the case of hydro-electric plants, the rights of downstream riparian owners is an outstanding consideration.

Then there is the consideration of the water supply, which I have already mentioned, and that is not an element of system load by any means, and then there is any limitation which exists by reason of any possibility of interference with the navigable water downstream.

There are other considerations which may loom up from time to time. I am sure I have not indicated all of them, but I think those are the major items.

Q. If there were no limitations of the character you have last mentioned, what would be the desirable method of operating the Radford project?

A. That question needs to be answered in respect of two conditions. One is not unimportant, but is relatively minor in point of time, and as I understand it in respect of this case. That is, the condition when there happens to be a full reservoir at the Radford project and an ample stream flow, so ample as to equal

or exceed the installed capacity. Under those circumstances it would be sheer waste if the Radford power station did not operate uniformly at full capacity, and incidentally under those circumstances it would operate at a capacity not of 9,000 second feet, which is the point of about maximum efficiency, but at
2608 something greater, about 10,000 second feet. The additional water utilized would be utilized at very low efficiency which could not be afforded except under conditions when otherwise there would be waste, but the principal use of the Radford power station, from the standpoint of time involved, would be when there is not enough water available, or when it is not desirable to utilize water beyond the economic prescriptions of the system as a whole.

Now your question being premised upon the absence of any limitations other than the system demands and the capacities of other power stations, and I would add water supply available from natural flow and storage, in my opinion the Radford power station would be utilized somewhere on the variable portion of the system load.

By Mr. JACKSON:

Q. Will you please define what you mean by base load and peak load?

A. I have used the term "variable load", as meaning above that portion of the load which represents the minimum load upon the system within, say, a 24 hour period. The portion of the load up to that minimum represents a continuous load upon the system in an amount below which the load does not fall at any time within, say, a 24-hour period and that is styled a base load.

Q. Do the base loads and the peak load vary within themselves or are they relatively constant?

A. Both base load and peak load vary, that is, they vary from day to day, week to week, month to month, and season to season, all on the assumption that the total load in the territory has not changed. In addition, there are variations due to changes in the territorial load. In times of depression the load grows less. In normal times, at least so far in the economic history of this country, there is a growth in the load and there is still another factor that enters. I have referred to the territorial load, meaning by that the market demand within the geographic area served in a retail manner by the distributing company, but there are also loads which come upon the system from inter-connected
2609 power systems, and not merely are there loads which come from those interconnected systems, but there are portions of loads furnished from time to time by the Appalachian Company to such interconnected companies, all of the factors

of which enter into the picture, and determine where an individual plant will operate in respect of the total load of the system.

Q. You said a moment ago that there were times when a part of the load came from interconnected systems. That is not clear to me. Do you mean interconnected systems would be contributing power or drawing power?

A. By the expression "load from inter-connected systems" I meant the drawing of power by such inter-connected systems, that is, systems other than the Appalachian Company, from the Appalachian systems' power stations.

Q. I thought you said afterwards there would be times when Appalachian would be contributing power to the other systems, which seemed to me to be the same thing. That is the reason I wanted to get it straight.

A. It would be the same thing and I probably was confused in my statement. I mean to state that because of the interconnections sometimes power flows in substantial blocks from the Appalachian system, and particularly from its power stations to adjoining systems or inter-connected systems, and sometimes power flows in the opposite direction, that is, sometimes part of the retail load of the territory of Appalachian Electric Power Company is supplied from power stations of inter-connected systems, sometimes quite remote.

Q. Colonel, where would the Radford project fit into the load of the Appalachian System?

A. In my opinion it would fit into the load nearer the upper portion of the peak rather than into the lower portion of the peak, always having in mind, however, these limitations other than the demands of the system and the characteristics of other power stations within the system. Whether it would be entirely on the top or in what we style a sub-peak position, or still further down, depends upon a multitude of conditions which would have to be appraised by the operating staff at that time,
but within the zone of the limitations that I have referred
2610 to, it would fit ordinarily within this broader scope of time into what may be styled some form of peak carrying operation of the system.

Q. Just before recess, in stating how the Radford project would fit into the load of the Appalachian system, you said that during a greater part of the time it would operate in some part of the peak but not necessarily at the top of the peak of the system. When you express the opinion that it would not necessarily operate at the top of the peak of the system, did you take into account the economic factors in the situation?

A. I should make clear, I think, that when I refer to some form of peak carrying operation I am referring to an operation within that part of the system load which is above the base load. in short, to that part of the system load which varies within the 24 hours of a day, for instance. Unfortunately, the terminology of the art, or at least, my own terminology is lacking in words which cover the point exactly. Perhaps for present purposes I might describe the broad zone as the variable portion of the load, but at times I do refer to that as the peak portion, meaning the variable portion of the load. It is entirely conceivable to me that at times the Radford plant might, from the standpoint of economic factors alone, occupy the top of the variable or peak carrying position. At other times it might be operating further down, but in response to the question of counsel as to the necessity of its operating at the top, I would say that in my opinion it is not necessary to operate at the top of the variable portion of the system load.

By Mr. JACKSON:

Q. In making that answer, do you take into consideration the economic factors?

A. I do. It is entirely possible, and even probable, that some other plant on the system, presumably a hydro-electric plant, would more appropriately assume the very top position. That depends upon the conditions obtaining at the time. I am referring now solely to economic factors, independent of the limitations of any consideration which would need to be given to the rights of downstream riparian owners or to any need for protection of the navigable capacity of some navigable water somewhere.

2611 Q. What is the characteristic of discharge from a hydro station operating on a base load?

A. It is relatively uniform. For practical purposes one might consider it absolutely uniform, though they never are absolutely so.

Q. What is the characteristic of discharge from a hydro station operating in the upper or peak portion of the load?

A. That characteristic is what I have already referred to, variability.

Q. What is the characteristic of discharge of a hydro station operating on a subpeak load as compared with one operating at the very top of the peak?

By Mr. THOMPSON:

What do you mean by sub-peak load? I don't think we have had that defined here, have we?

A. In the term "sub-peak" there occurs that word "peak" to which I have already referred as being subject to more than one interpretation. As used in that particular phrase "sub-peak", the word "peak" means the top of the variable portion of the load and "sub-peak" means a load which is under the top of the variable portion of the load and yet is within that variable portion. It may be at the bottom or it may be at some point intermediately between the bottom and the top of the variable portion of the load.

By Mr. JACKSON:

Q. What is the characteristic of discharge of a hydro-station operating on a sub-peak load as you have defined it, compared with a hydro station operating at the top of the peak?

A. The station or stations operating in a sub-peak position would have a variable load but one involving less variation than in the case of a plant operating at the top of the variable or peak load.

By Mr. JACKSON:

Q. Variable load is the same as variable discharge?

2612 A. They are analogous. I fear I went astray from the question. If the question was predicated upon discharge any adjectives of characterization would apply essentially to discharge just as they would to load because, broadly speaking, the discharge is directly proportional to the load, that is, in the case of a hydropower station, operating in a subpeak position, the discharge is less variable than is true of the discharge from a station operating at the top of the variable or peak portion of the load.

Q. Col. Scheidenhelm, is it possible to say now precisely how the Radford station would be operated?

A. It is not possible to say now precisely how it will be operated. I believe it is not feasible to go beyond the broad description which I have made. When the time comes for operation there will have to be taken into account the characteristics

2613 of the total load on the system, including both the territorial and the interconnecting portions of that load. Likewise, the characteristics of the other power stations of the system, including their capacity, their location, their relative economics. There will have to taken into account the water supply available for the Radford station and likewise for the other hydro stations, and there will most certainly have to be taken into account the necessity on the part of the operating staff to avoid taking any chances of incurring liability with regard to down-stream riparian owners or with regard to any

Governmental authorities insofar as navigation anywhere is concerned, and undoubtedly there will also be other limitations which will be dictated as matters of good business policy.

Q. Do those considerations establish a zone within which it is possible to say the future operations would fall?

A. Yes, they do establish such a zone. That is, laying aside the relatively minor part of the time when, in the absence of extensive headwater storage, the Radford plant would be operating at full capacity because of high water and full reservoir conditions, the Radford operation would fall somewhere within the variable portion of the system load.

Q. In determining the economic justification for a hydroelectric development, is such a project considered upon the basis of a relatively short or long life?

A. In that respect a hydroelectric development differs substantially from a steam-electric power development. The hydroelectric development would ordinarily be expected to have a life, of, let us say, from 50 to 100 years. Its economic justification must be appraised in the light of that long term of life. If a project follows the average of the experiences of hydro-electric projects built, it will have lean years, at least during the beginning of its operation. There are very few hydroelectric projects which have not had early years of red ink, so to speak, but the life of a hydroproject is so long that the debit balances of the early years can be spread over the remaining long period without weighing any individual year or years of that period too heavily.

With a development like a steam-electric power station the
2614 opposite is true. A steam-electric plant must begin to earn its keep, so to speak, quite early in its life.

Q. Do those considerations have any effect upon the operation of a hydro-electric development in the early years of its life?

A. They would have this effect, that if because of absence of load or of excess of generating capacity elsewhere, or because of any limitations other than the normal economic factors, that is, if because of the limitations having to do with downstream riparian owners or any necessity for avoiding any liability in respect of effect upon navigation, if in regard to any of those things, it is necessary for some years to operate differently than mere economic factors would indicate, the result is merely in line with the ordinary experience of hydro-electric plants. As a matter of fact, under present circumstances, if the Radford plant should be brought into operation within, say two years, it is very likely that the system would have an excess of capacity to the extent of part of the Radford capacity; that is 75,000 kilowatts of additional capacity thrown upon the system at one time, may

possibly be absorbed, but very likely it would be more than would absolutely be necessary at that particular time.

Q. Colonel, from what you have said as to the long life of hydro-electric plants, in planning or constructing a hydroelectric plant, do you take into consideration, for instance, other plans for head-water storage reservoirs or things of that character on the same stream?

A. That must necessarily be done. If in the case of a project like the Radford project there were any question as to the amount of capacity to be installed or the number of units to be installed, that question can properly be decided only before the plant or as the plant is being built. It cannot be postponed to the future without extensive costs, which undoubtedly would outweigh any conceivable advantage from a future change. Therefore, it is necessary to plan over the long range, to begin with, and capacity, for instance, must be set in the light of what is believed, in the light of the very best existing information, to be the reasonable prospect for the future.

Q. Then in designing and planning such a project, state whether or not consideration is given to other projects of the same company for development on the same stream?

A. Consideration would most certainly be given to other
2615 projects. Consideration would be given to the long range program.

Q. State whether in your view any re-regulating capacity below the Radford Reservoir is essential?

A. In my opinion, it is not, so far as concerns the Radford project.

Q. State whether or not under the plans of the defendant and its affiliates, for the development of power on New River, there nevertheless will be reservoirs having reregulating effect if those plans are carried out?

A. The plans of the Appalachian Electric Power Company and its subsidiary, West Virginia Power Company, do involve developments down-stream. They have gone so far as to include definite engineering plans in general, though not detailed, and they have involved expenditures running into great sums for investigations and acquisitions of lands and rights and dam sites. One of those projects is the Bluestone Power Project as shown upon Exhibit 600 which would involve a reservoir than which one could hardly conceive a better reregulating means for the Radford project.

By Mr. JACKSON:

Q. Were those plans of the development of power developments on New River made before or after the Government proposal of the construction of its Bluestone project?

A. Years before there was any thought, so far as I know, of a Federal Bluestone reservoir project.

Q. Colonel, I believe you have already stated that in your judgment in the early years of operation of the Radford project, its capacity probably would not be needed by the defendant's system in full?

A. Yes.

Q. Does that mean that the Radford plant, under those conditions, would waste water?

A. No, indeed, but it means that the utilization of the Radford output in terms of capacity and energy would not be to so great an economic advantage as would result when the system needs the entire capacity. Thus the system of requirements are large enough so that all energy which can be produced at a hydro-station existing upon the system, including the Radford project, would undoubtedly be absorbed, and that means, to avoid waste, it would displace energy and capacity that would otherwise be produced by existing steam stations. To put the answer in another way, the saving would be definite, but would largely
2616 be merely in coal or fuel saving rather than coal and fuel and labor saving, plus the fixed charges upon capacity which would otherwise have to be installed elsewhere.

Q. Does this circumstance that the defendant's system might not require the entire capacity of the Radford plant as soon as it is ready for operation affect the economic justification for the plant, in your opinion?

A. Yes; that is a consideration which has entered into my appraisal of the economic justification of the development and must enter into any intelligent appraisal of that situation. Having appraised it, however, the prospect of going along for any great length of time without the development of a demand for all of the available and reliable and emergency capacity of the Radford project is such that it does not outweigh the other advantages. The result is that the project as a whole, and in terms of its long life, is economically justifiable.

Q. You have testified that in your opinion, except during high water seasons, the Radford plant would be allocated some portion of the variable load of the Appalachian system. Please state whether on such an allocation the Radford plant would be operated on the same basis everyday, day after day and week after week?

A. It would not.

Q. By Mr. JACKSON. Can you explain that a little more fully?

A. We are treating now, as I understand it, periods other than high water periods?

Q. That is right.

A. Within the period that may be broadly characterized as one of moderate and low flows, the specific kind of operation or method of operation would be determined by the availability of water in that stream flow and in the reservoir, and also there would be the considerations of load, power from other sources and those limitations which have to do with down-stream conditions to which I have already made reference. In the light of all of those, I believe that there would be variations from day to day and from week to week, but, generally speaking, I would think that there would be about the same kind of operation for the five days of the week, beginning with Monday and ending Friday; that over the other days of the week, Saturday and Sunday, the operation would be different.

2617 Q. In your opinion, would there be operation of the Radford station on Saturdays?

A. There would be some operation on Saturdays, but to a somewhat lesser extent than on other week days. The tendency—it is more than a tendency, so far as the Appalachian Electric Power Company's system is concerned—is to operate hydro-electric plants on Saturdays, but with maximum loads less than those on the five principal week days. The operation even extends into Saturday evening, or late afternoon peaks.

Q. In your opinion, is it reasonable to assume that there would or would not be operation of the Radford station on Sundays?

A. I would suppose, in the absence of any limitations other than strictly economic and service factors within the system, there would not be any operation on Sundays. However, it is a fact that there is a growing tendency on various power systems, and on the Appalachian Electric Power Company's system itself, to go into some form of Sunday operation, in prolongation, so to speak, of that tendency which has resulted in Saturday operation, but at present, I don't believe that tendency has gone far enough. My idea of the situation at present would be, in the absence of other limitations such as I have mentioned, there would not be any Sunday operation.

Q. In your opinion, it is reasonable or unreasonable to assume that the Radford power station would be shut down in prolongation of Sunday or Saturday, or Saturday and Sunday, by including either a Friday or a Monday?

A. That is very improbable. Certainly I cannot conceive of that taking place so far as to violate any limitations as regards down stream conditions, either of riparian owners or as affecting the navigable capacity anywhere.

Q. When you say limitations, do you mean any possibility of affecting those interests?

A. I mean limitations which would cause—limitations which would take the form of a decision by the operating authorities to avoid any possible risks of interfering with the rights of others or with navigable capacity.

By Mr. JACKSON:

Q. Well, would the opinion you have just expressed, 2618 with reference to the reasonableness of an assumption of a shut-down in the week-end being extended to include either Friday or Monday, be affected by whether or not Friday or Monday might be a holiday?

A. No. Such circumstances are so rare that, quite aside from any other pertinent conditions, the savings which could result from not operating on Friday or on a Monday holiday, would be so small that it would just not be worth while to take any chances or risks involving the interfering with rights down stream. The saving would be of the order of a few hundred dollars, and there is another factor that would enter into that situation; with a large system, the mere inertia of an operating program or routine is such that, if upset for a single day, it involves a cost in effort and communication that interposes a barrier to any change in the routine.

Q. What is the operating plan for the utilization of the Radford storage?

A. The Radford storage will be filled during a period of higher flow and drawn upon during periods of lower flow. If it were used to the extreme extent of ironing out the low flow periods, so to speak, to the point of filling the valleys in the low flow periods, by means of a level line, a water filled valley, so to speak—then the operation would be governed by what would have been the experience during years of lowest flow, such as the years 1925 and 1930, on the basis of what would have been the experience during those years, had the Radford project been in existence. The storage of the Radford reservoir would not be drawn upon to any material extent prior to the beginning of such a low water period, and that beginning of low water period would find the reservoir full.

If the reservoir were operated so as to obtain the maximum energy output from the stored water, the aim would be to fill the low water season valley to the maximum and that would result in the equivalent of an average flow through the low water period of about twelve hundred second feet.

However, I am very skeptical as to whether that reservoir would be drawn upon to that extent—that is, to the extent
2619 of an average of 1200 second feet during low flow periods.

This is due to another factor in system operation, which I have not called by name, but that is very potent, and that is the policy of giving reliable service. The relation of the water in that storage reservoir to service on the system is very important.

If the reservoir is filled, it has a potentiality of full emergency service. I have already referred to that in connection with emergency capacity, but if the reservoir is almost empty, as it would be under such strict operation for leveling out the flow to the maximum extent in the low water season, then towards the end of the low flow season, the potentiality of emergency service would be present to a far less degree than with the reservoir more nearly filled.

The head, for instance, would be down and the total capacity which could be available, would have been reduced from 75,000 kilowatts to 53,000 kilowatts, and the time during which the 53,000 kilowatts would be available would be reduced in even greater proportion.

Therefore, I think that the tendency of system operation will be more and more to reserve portions of the 100,000 acre feet storage for insurance against emergencies.

Q. Colonel Scheidenhelm, as I understand you, the figure 1200 second feet is based upon the low flow of 1930?

A. That is true.

Q. How much——

A. (Interrupting.) I beg your pardon—1925 and 1930.

Q. How much does the storage augment the low flow for those years?

A. Roughly, it results in doubling the low flow.

Q. And that is on the site of the Radford Dam?

A. That is true.

Q. Well, assuming that one would not refrain from drawing down the utilizable storage gradually during low water—during the low water season, would that mean that the water would be used uniformly at the rate of 1200 second feet throughout that low water season?

2620 A. It does not. That 1,200 second feet would represent an average over months of low flow period, extending roughly over a total of six months. Within any one day, there would be fluctuations from the average of 1200 second feet. Undoubtedly, the average flow of one week would vary from the average flow of another week, but when one goes to periods as long as a month, I would expect it would be normal—it would

be usual—the usual operation of a reservoir of this kind for the average flow of one month to practically equal the average flow of the other, and 1,200 second feet is the approximate equalized flow over the entire low water period.

Q. To what extent would the operation be affected by the character of a particular year, as a good or bad water year?

A. In a good water year, the daily use of water, meaning the average daily use of water, would, of course, be greater, and if it is a good water year, it will have manifested itself by better than low flows in July and August, and by that time, it will be apparent that a greater flow than the average of 1200 second feet can be utilized, and the result is a larger daily average utilization of water.

Q. Assuming that you encountered a year of greater drouth than previously experienced, would that have any effect on operations during that year?

A. Such a period would undoubtedly make itself manifest in the early summer, and if it should happen that, about the first of June, the flow in New River at the dam site, after making corrections for any interference and changes in the flow upstream, should fall or remain below 1200 second feet, that would be a signal, and any intelligent operation of the Radford project would result in cutting the cloth to suit the new circumstances—that is, it would result in a utilization of an average flow less than the flow of 1200 second feet.

Indeed, I would expect, for reasons that I stated, that the tendency would be to operate under 1,200 second feet, even in a 1930 low water year, rather than over that, but possibly the tendency to operate at 1200 second feet during low water years would remain.

2621 Q. What, in your opinion, would be the likelihood of all of the utilizable storage designed to provide 1200 second feet being drawn down and exhausted before the end of the low water season?

A. I consider that extremely unlikely. It is a theoretical possibility, if one wanted to follow out what has been referred to here under a nomenclature new to me, that is the rule curve, but aside from the theoretical possibility, I would not think it would happen. Rather the considerations of protecting the service, you would have some degree of reserve—some money in the bank, so to speak, and I would not expect the reservoir to be drawn down to the ultimate limit of the utilizable storage.

Q. What, in you opinion, would be the likelihood that the utilizable storage would be drawn down and exhausted prior to or early in a low water season?

A. That is merely an academic question. That is just utterly unreasonable.

Q. State your reasons more fully with relation to anything of that character.

A. I have, I think stated the essence of that. It merely means what perhaps may be explained by analogy. If a certain family is dependent upon an annuity received from an insurance company once a year, and received that annuity early in the year, then the part of wisdom is to spend only out of that in such a way as to make it last throughout the year. I think then that the use of storage is pretty analogous to that. The use or drawing down of storage ahead of low water year is unwise. It represents, in my opinion, unintelligent operation, for the reason that, during the low flow, there would not be a period for storing the water in the reservoir, and that would be contravention of the very purpose of providing storage.

Q. What effect would it have upon the reliability of the service of the Company?

A. This previous drawing down of the storage capacity of the reservoir would result in making an unavailable emer-
2622 gency capacity in the system and not merely an emergency capacity, but a great part of what would otherwise be reliable capacity.

It would result in reducing the daily average proportionate to the discharge and hence the output from the station from the level of approximately 1200 second feet to a level of approximately 600 second feet, which is in the neighborhood of low natural flow.

Q. In your opinion, is it to be reasonably or not reasonably assumed, or it is reasonable or unreasonable to assume that the Radford project would not be subject to shutdowns, other than possible week-end shut-downs of the character and extent you have described?

A. It would be reasonable to make that assumption.

Q. You have stated that the capacity of the Radford power station is approximately 75,000 kilowatts. Please state whether or not that is all reliable capacity.

A. In my opinion, that is not all reliable capacity. The question as to what is reliable capacity is essentially one of engineering judgment, and that must be exercised in the light of system requirements and possible methods of utilization.

The reliable capacity of the Radford project, I would appraise as somewhere between 35 and 45 thousand kilowatts. That appraisal, which is one that I have put before the company, is part of the economical justification of the project, as predicated upon

the use of the project which, in my opinion, will be made of it during the periods of low flow, and it is, therefore, tied to the estimate of 1,200 second feet, or what one may call re-regulated flow during low water periods.

Q. Have you stated the factors that limit this reliable capacity—you stated fully how the water supply limits that capacity?

A. In that respect I would think my previous explanation would be applicable—that is, the natural flow of the stream augmented by the full extent of the utilizable storage throughout the low water period, strictly limit the output in terms of energy, and, therefore, limit also the output in terms of capacity. It just is not practical to utilize 1,200 second feet days on the average in such a way as to support a peak of 75,000 kilo-
2623 watts; moreover, as the reservoir levels approach a practical limit of 27 feet draw down, it becomes impossible from the standpoint of head alone for the power station to turn out 75,000 kilowatts.

At that limit, the draw down being zero and the utilizable storage also the available capacity is reduced to about 53,000 kilowatts, that limitation cannot be avoided.

The further difference between 53,000 kilowatts and the rate of 40,000 kilowatts or 45,000 kilowatts, of which I made mention, is due to the fact that the amount of energy available from the water to back up the capacity is limited.

Q. On that basis, Colonel Scheidenhelm, what would be the volume of water available for peak carrying during the five principal days throughout the low water season—the five principal days of the week?

A. I took it on the assumption that the average utilization throughout the low water season of 1200 second feet continually—the average of 1200 second foot days every day.

Q. This would be on the basis, as I understood you to say—it was the limited reliable capacity of the plant during the low water season?

A. Yes, sir; on that basis, the available water in terms of volume being 8400 second feet days per week, in my opinion, would spread over six days of the week with a greater utilization of the five days, Monday to Friday, inclusive, and the average utilization for one of these five days would be about 1,550 or 1,560 second feet days.

The utilization on Saturday would be lower, perhaps something on the order of 600 second feet days.

Q. What is the volume of flow which ordinarily would be available for use to the Radford power station?

A. Taking into account the natural flow and the available storage, I would say 2,000 second feet may practically be characterized as the flow ordinarily available.

Q. How does that compare with the average flow at the dam site?

2624 A. That is a little less than two-thirds of the average flow at the dam site.

Q. And how would such an ordinarily available flow be utilized?

A. If I may say first, by ordinarily available flow I believe is meant the ordinarily available flow for a point of time throughout the year or a term of years. As to the utilization of it, I would expect that it would fall within that zone that I have described as the probably zone of operation for the Radford power station. That would mean that there would be available for a week's output something like 14,000 second feet days per week on the average, and I would expect it to be operated in somewhat the same proportion as would the output resulting from regulated flow at the average rate of 1,200 second feet days.

Q. How much would that make available on each of the five principal days?

A. I could make a computation or refer to some figures I have here.

Q. You can get a memorandum and look at it, if you want to.

A. (Witness leaves witness stand and procures papers and returns to witness stand and figures.) I would say about 2600 second feet days, that is for each five principal days, with another thousand second foot day used on Saturday, making a total of 14,000 second feet days available for a week.

Q. Would a 2,600 second foot day be the maximum which could reasonably be available for some form of peak carrying operation during each of the five principal days of a week.

A. No, sir.

By the COURT:

If they used 14,000 a week, and 1,000 on Saturday, there would be 13,000 through there, thus giving it only 2,600 second feet?

A. Assuming no operations on Sunday.

By Mr. JACKSON:

Q. State whether or not in that distribution of the maximum amount which might be expected to be available in peak-

2625 ing for anyone of those five principal days—if anyone of those five principals days would be limited to 2600 second feet?

A. No, sir, there could be variation among the five days, but I would think in the close neighborhood of 3,000 second feet days would represent the maximum which would be used under these circumstances.

Q. What, in you opinion, would be a reasonable form of peak carrying discharge at the Radford station for utilization of 3,000 second foot days' water in a single week-day operation?

A. I consider a reasonable form of discharge is that depicted on the chart forming Exhibit No. 594.

Q. Is that a form of discharge utilizing 3,000 second foot day?

A. Yes, sir.

Q. Does that assumed form of discharge from the Radford station, shown on Exhibit 594, compare in relation to the load requirements of the Appalachian Electric Power Company?

A. Yes, sir.

Q. What is that relationship?

A. That represents, in my opinion, a reasonable allocation of load. It cannot particularly be set up to represent any special allocation that would ever occur, but it would be very close to something, in my opinion, that would occur time and again.

It is my idea of a reasonable expectation as to one of the heavier forms of peak carrying which could be expected to be taken by the Radford project. It represents an operation that would be towards the top rather than further down on the system load. It represents an operation above rather than in a sub-peak position.

Q. Well, do any other assumptions enter into the form of discharge shown on this Exhibit 594?

A. I believe it has already been brought out that that chart is predicated on a week day operation, and upon such a week day operation as will utilize the discharge of water, I will say, of 3,000 second feet days.

The allocation of load is predicated upon the assumption that there would be no limitations of any kind by way of neces-
2626 sity for preventing any interference with navigable capacity on the Kanawha River or any necessity by way of modifying the operation so as to prevent the incurring of any risk or liability of interference with downstream riparian owners.

Q. This form of discharge on Exhibit 594 has been worked out purely upon considerations affecting the system load and the system stations. Is that right?

A. Yes, sir. It is predicated solely on the economic factors other than those relating to downstream conditions.

Q. Its form was not modified in any respect by reason of any possible relation to riparian property owners downstream or any navigable conditions on the Kanawha River?

A. That is true.

Q. And does that mean, in your opinion, that the question of property rights downstream or navigable conditions on the Kanawha River would play no part in the adoption of a method of operation of such a plant?

A. By no means does it mean that.

Q. Was this form prepared for the purpose of testing the result of such a form of discharge?

A. Yes, sir, it was prepared for that purpose and, while not in the precise form of this chart—this chart was furnished by me to Professor Harold A. Thomas for the purpose of his studies and tests.

Q. You have testified that, in your opinion, the form of operation shown on Exhibit 594 would be a reasonable one?

A. Yes, sir.

Q. Are there other possible forms of the operation of this project?

A. There are many, many other forms. Of course, there enters the question as to how minor a variation one can have and still keep within the same form—but I am taking into account minor variations when I say that—but it is within the general scope, the general zone of the kind of operation which I would expect for that project, if there were no limitations of the
2627 kind so stated, but I would think it was nearer the upper limit of the available load that would be carried by the Radford plant, rather than being the approximation of the average availability or available load that would be carried by Radford.

Q. What I wanted was other methods of the operation of this project; which, in your opinion, would be reasonable, whether in the scope of field operation, it includes a number of methods of operation or not?

A. I think it does include a number of methods of operation, when one goes into the field of theoretical operations. I think, so far as the upper limit of variations is concerned, that anything materially more variable than this would not be reasonable.

Q. Are there many variations below that limit?

A. Below that limit there are many, many variations.

Q. Are you familiar with the testimony of Professor Thomas in this case?

A. Yes, sir.

Q. Have you given any consideration to the rectangular or block form of discharge from the power station? Mr. Thomas testified that he considered that in connection with his study of the power tides from the Radford station?

A. I have. I gave consideration to that form, prior to the work of Professor Thomas, and was responsible for his studies and tests with that possible form of operation, but I looked at it as embodying the literal meaning of possibility without any possibility of being probable, let alone certainty; I considered it to be a theoretical form—a theoretical plaything rather than anything in my opinion tnat would be reasonable to conceive as a natural occurrence.

By Mr. THOMPSON:

Q. That is the rectangular wave?

A. Yes, sir.

By Mr. JACKSON:

Q. Why did you consider the rectangular form of wave?

A. I felt that it represented the extreme outer limits of possibilities in the matter.

2628 Q. Physical possibilities?

A. Physical possibilities of discharge in a total volume of 3,000 second feet days, being the extreme outer limit. I say anything reasonably conceivable of occurrence would fall inside of it. From that standpoint, it was not merely of general, but of special interest.

Q. What would be the volume of this rectangular wave?

A. 3,000 second feet days in the form I studied the situation and in the form I requested Professor Thomas to study and test it.

Q. That is meant that the wave was of a duration of that amplitude?

A. It was of that duration with an amplitude of 9,000 second feet propagated instantaneously and continuing throughout eight hours and then dropped to zero instantaneously. Practically that sort of thing does not occur.

Q. What was the respective duration of the discharge represented by the form of the discharge shown in Exhibit 594, and the form of discharge shown by rectangular block wave?

A. The latter, the block form, discharged from Radford station would have a duration of eight hours and that form represented in Exhibit 594 has a duration of 16½ hours.

By Mr. JACKSON:

Q. Col. Scheidenhelm, are you familiar with what has been referred to in this case as the 1930 wave tests?

A. I am very familiar with them.

Q. Will you please state if you know the circumstances under which those tests were made, including your relation, if any, to the tests?

A. In order to understand how that series of tests of power waves or power tides from the Buck and Byllesby station came about, it is well to refer to the fact that beginning with the making of Declaration of Intention on the part of the Appalachian Electric Power Company in respect of the Radford project, various studies were made from time to time by the United States, District Engineers Office, at Huntington, and to some extent presumably by the Federal Power Commission, with regard to the fluctuations which existed or took place in the flow of New River, due both to the routine peak carrying operations of the Buck and Byllesby hydro stations and the natural fluctuations in New River due to rains.

2629 Those studies of the Engineers Office at Huntington cover various periods of time in the years 1925 to 1927, and perhaps later. The studies themselves, I think, did not begin until 1926, but the first periods studied in 1926 were those of flows which actually occurred in 1925. After each of these studies, there were conferences on my part with representatives of the United States Engineers Office at Huntington, and consideration was given to the results. Each time the attitude of the Huntington office was essentially to the effect, in statements to me, that the results are inconclusive. That condition carried on for several years, and with a view to doing something which would be constructively and positively helpful in solving the problem which appeared to be troubling members of the staff of the Federal Power Commission, I proposed a series of tests which went far beyond the routine operating variations out of the Buck and Byllesby hydro stations. That resulted in the so-called 1930 power wave tests.

Q. Describe briefly how those tests were made?

A. Those tests were accomplished by having the Power Company in effect turn over to me the operation of th' Buck and Byllesby hydro stations, including power plants and reservoirs. In order to obtain variations in discharge from those hydro stations greatly in excess of the natural power station discharges, it was necessary to use, and there were actually used, the spillway crest gates and the pondage of the Byllesby and Buck reservoirs. Water was allowed to be stored back of the Byllesby crest gates until, in most cases, there was actually some flow over the tops of the gates. The same was done in the case of the Buck station.

In the meantime, there was no operation of the power station, so that the stream flow downstream from the power station was as low as was permissible, without interfering with the needs of a certain riparian owner. That riparian owner was National Carbide Company, or, possibly, National Carbide & Carbon Com-

pany, which had a plant located just a few miles downstream from Byllesby and Buck. These water requirements were met through the tests; but, with the exception of that particular item, the discharge was withheld until both ponded over top.

2630 When that point had been reached, then, as nearly simultaneous as possible, the power station at Byllesby was put into full operation, and the crest gates on the spillway of the Byllesby station were opened, thus releasing a tremendous wave or discharge of water, which very soon found its way into the Buck pond, and, when that wave reached the Buck dam and power station, then, as nearly simultaneous therewith as possible, the Buck station head gates were opened and the spillway crest gates of the Buck dam were opened. Thus the combined capacity of the two power stations and their spillway gates discharges were utilized to create as great discharge as possible.

Q. What was the maximum discharge during those tests?

A. The discharge reached a maximum, of course, at the Buck power station or just at the foot of the Buck development. At that point there were no reliable means of measurement, but at the Ivanhoe gaging station, located two or three miles downstream from the Buck station, it was possible to measure amplitude.

Q. Will you state what was the maximum discharge during your tests, first, as shown at Ivanhoe?

A. At Ivanhoe the discharge reached a maximum which, I believe, was a little short of 14,000 second feet. In my opinion, at Buck station the discharge must have reached an amplitude in second feet somewhat in excess of 15,000.

Q. Were these tests carried on in cooperation with anyone by the power company?

A. They were carried on in cooperation with the United States Engineers' Office at Huntington, with two District officers of the Water Resources Branch of the United States Geological Survey, and with the staff of the Federal Power Commission.

Q. What part, if any, did the representative of the Water Resources Branch of the United States Geological Survey take in the tests?

A. The District Engineer for Virginia, Mr. Dirzulaitis, co-
operated by installing temporary automatic recording
2631 gages, in rating or re-rating various gaging stations, and in taking off the charts and computing estimates of discharge in the light of those charts. Similar cooperation was rendered by the Geological Survey District Engineer for West Virginia, Mr. Kessler, whose headquarters are at South Charleston, West Virginia.

Q. What was the relationship of the United States District Engineer at Huntington to the tests?

A. The tests were planned in thorough cooperation with his office and in personal conferences with him and his staff.

Q. Who was the District Engineer at that time?

A. Lieutenant Colonel Ardery, now Colonel Ardery.

The District Engineer instructed the personnel along the river to make special frequent gage readings at most of the locks and dams, and, for that purpose, I believe supplied some special personnel. Also, careful observations were ordered to be made, and were made, of all of the dams, including the wicket performance, and of course, the records of the maneuvering of the wickets at each of the eight wicket type dams which were then in existence.

Q. You say there were eight wicket type dams then in existence?

A. Yes.

Q. Were dams 2 and 3 then in existence?

A. They were then in existence. They were of the fixed type.

Q. What was the relationship, if any, of the Federal Power Commission, or its agents, to the tests?

A. The tests had been discussed in personal conference with the then Chief Engineer of the Commission, Lieutenant Colonel Max Tyler, who had just been nominated Brigadier General of the Corps of Engineers.

During the tests there was sent to observe a member of the Engineering staff, Mr. N. B. Keeler, who was present during a part of the time on Kanawha River.

Q. State whether or not these tests were made directly under your supervision?

A. They were. I had general charge of the operations, and of course I kept in touch with the system operating staff of the Appalachian Electric Power Company as the power sta-

2632 tion had to come on suddenly, and at times when the system operating force needed to know such was going to happen in order that they might be prepared to absorb the power outputs of the Buck and Byllesby power stations because, perforce, the operation of the power stations was conducted solely for the best interests of these tests and not as the stations would normally be operated. That is, sometimes the discharge from Buck and Byllesby plants occurred at nights, at times when otherwise there would not be any special heavy output from the power station. I had an assistant in charge of the test operations at the Buck and Byllesby power stations, and another assistant in charge of operations at the navigation dams along Kanawha River.

Q. Was the discharge at Buck and Byllesby limited to the capacity of the power stations?

A. It was by no means limited to such capacity.

Q. Colonel, please state the results of the 1930 wave tests, so far as concern the action of the waves or power tides in their travel down-stream?

A. The outstanding result of the tests was a substantial reduction in the amplitude of flows of the tides from the amplitudes as they obtained in passing Ivanhoe gaging station until, when those tides or waves reached the Kanawha River, they were essentially minor in amplitude. Also, there were substantial reductions in volume of the waves. The precise amount of this reduction is rather difficult of determination because of certain gaging station characteristics, but the amplitude in feet or stage is not subject to any complication, and that involved very definite and very extensive reduction from Ivanhoe down to Kanawha Falls and to the several locks down-stream on the Kanawha until the waves became undistinguishable.

Q. Did any of these power waves or tides increase in amplitude at any point of their travel downstream?

A. I am not certain that any increase in amplitude in second feet took place, but it is not unlikely that there were some minor increases in amplitude within the first 20 or 30 miles of travel of the tides down-stream from the Ivanhoe gaging station, but once that distance had been traversed, the reduction in amplitude became marked and continuous.

Q. Assuming there was a small increase in amplitude, say a short distance below the point of discharge, what, if any, significance would that fact have on the questions which you were considering?

2633 A. On the questions which we were then considering, it had no significance because the important question was what would be the result of those power tides after they had traversed the distance of ordinarily 200 and 300 miles—namely, what was the result in the Kanawha River.

Q. Was there any effect on the power tides by in-flow as they passed downstream?

A. Yes, During the period of the tests, there were various natural tides resulting on the main river and on tributaries, so there were various complicating in-flows which affected and in some cases augmented the power tides.

Q. How far downstream could these power tides be detected?

A. They were all distinguishable as far down-stream as Lock No. 5. A few were distinguishable as far downstream as Lock No. 9. Others were not. None of the waves were distinguishable at the last lock on Kanawha River, No. 11.

Q. Did you state the fact with reference to the condition at Lock 9, or not?

A. I do not recall at this moment. I have the impression—I think I had better refer to my record in that respect.

Q. Here is your record (handing same).

A. I misstated the conditions in respect of Lock 9. I was in error in stating that any waves were distinguishable at Lock 9. At least, that is the extent of such records as I have, and it is true equally of Locks 10 and 11.

Q. Colonel Scheidenhelm, I show you a chart, which is in evidence as Government Exhibit 143, and ask you whether you are familiar with that chart?

A. I am.

Q. State, if you know, whether that chart shows all of the operations, or maneuvers, of the dams during the wave tests?

A. It does not.

Q. Is it substantially complete in that respect, or not?

2634 A. No, It is very incomplete. There are a few maneuvers indicated, but by far the greater number are not indicated thereon.

Q. During these wave tests, did the wicket operations affect the volume and amplitude of the waves shown on that chart?

A. They did.

Q. Will you state why and how that was?

A. Well, as wickets are lowered at a moveable type of dam—that is at a wicket type of dam—the result is to release water from the pool controlled by these wickets, and, therefore, is augmented the flow which would otherwise obtain past the dam. If a wave or tide happened to be passing that particular dam, then there is contributed into the volume of that wave a part of the pond capacity of that particular pool. Conversely, if wickets are raised, then there is subtracted something from the volume of a passing wave, but there is a change in gage reading of the pool level, such as to distort what otherwise would be the conditions obtaining at that site. It may result in an increased amplitude reading in terms of stage.

Q. State, if you know, whether the hydrographs of the 1930 wave tests, insofar as they disclosed any amplitude in second feet, are based upon a single rating curve?

A. For each gaging station there was applied only a single rating curve.

Q. What, if anything, is the effect of that circumstance with reference to the degree of accuracy of the readings of amplitude and volume in second feet?

A. The necessary consequence is that there was not taken into account the effect of rising and falling stages. The rating curves

are generally applicable for conditions of steady flow, but there were natural changes in flow taking place in both New and Kanawha Rivers throughout the 300 miles of this full size laboratory, and, in addition, the very power tides themselves meant rising and falling stages. That is axiomatic of a power tide or wave, and the various discharges corresponding to a given gage height, could not be reflected by the use of a single rating curve for a given station, as was actually done. In consequence, the hydrographs contained in them errors as to the magnitude, of which we have no precise knowledge, but can make esti-
2635 mates, if necessary, though I would hesitate to do so; but we do have knowledge that on ascending and descending stages they are not correct.

Q. Are those errors in hydrograph applicable to stage as well as volume?

A. They are not applicable to amplitude in stage, but merely in terms of discharge, or in terms of volume, because a function of volume is the amplitude in second feet, namely, in flow.

Q. You have already stated that during these wave tests there were substantial reductions in amplitude in second feet, as the waves passed downstream? Will you state whether there were reductions in amplitude expressed in feet of stage as the waves passed downtream?

A. There were very great reductions in feet of stage.

Q. Can you give some examples of that from the records of the tests?

A. Yes. The greatest amplitude of a wave in stage was apparently that of a wave which for convenience we numbered #15 at Ivanhoe as this wave came by the water rose practically seven feet in a very short period of time. By the time that wave had reached Lock #2 it had decreased in amplitude to five inches. The least amplitude in inches of any wave was in the case of #16, which had been propogated in somewhat similar fashion. In that case the amplitude at Lock #2 was three inches. However, those were especially peak waves which were of high amplitude in second feet, and by reason of the limitations in water supply were not of great duration.

Q. You mean high amplitude in second feet or in stages?

A. Both.

Q. In stating these amplitudes in stage, as I understand it, you are again stating the amplitude in stage at Ivanhoe station and not the point of discharge at Buck dam?

A. That is true. At Buck discharge must have been greater.

Q. What was the greatest amplitude in stage of any of the test waves at Lock #2?

A. It was approximately nine inches in the case of wave #6, hich had had an amplitude in stage of four feet eight inches at Ivanhoe. However, that maximum amplitude at Lock
336 #2 was in my opinion affected by a rain inflow. I do not know to what extent its amplitude was increased because a natural increase locally in the Kanawha or from some earby tributary, but it did affect it somewhat.

Q. Referring to wave #4 of these tests please state the amplide in stage at Ivanhoe and at Lock #2.

A. At Ivanhoe the amplitude was approximately four feet. t Lock #2 it was approximately six inches.

Q. Please state the amplitude in stage for wave #10 at Ivanoe and at Lock #2.

A. At Ivanhoe it was approximately six feet. At Lock #2 it as approximately seven inches.

Q. Please state the average reduction in amplitude measured stage for all of the waves of the 1930 wave tests between anhoe and Lock #2.

A. For the eighteen waves the average amplitude at Ivanhoe as about five feet three inches. At Lock #2 the average amplide was about five inches. I might say that the amplitude in age as I have given them in figures represent the vertical disnce between the crest of the wave and the base flow, as repreented in turn by a straight line connecting the lowest points troughs on either side of the wave crest.

Q. Were there any complicating conditions during the 1930 ave tests?

A. There were the conditions of rains which caused natural anges in flow in New River and in Kanawha River and various ibutaries. There is hardly any, if indeed any, wave of the ries that was not so affected.

Q. State whether any of the power tests, or waves, which me into the Kanawha River during the 1930 wave test, as a sult of those wave tests, caused any interference with navigaon on the Kanawha River?

A. They did not.

Q. Col. Scheidenhelm, what, if any, investigation did you make the results of these waves on the Kanawha River during the 1930 wave test?

337 A. Well the object of the series of tests was not merely to propagate the waves or tides, but to find out what they ould do. Now it was manifestly impossible for anyone individul to be everywhere at the same time, but I had observations ade everywhere; they were reported to me. My assistants reorted directly. I conferred with the representatives of the

District Engineer office and the District Engineer himself, and I am as certain of the results of that particular investigation as I would be of any other engineering investigation which I would be called on to make, and as a result of which to make a finding for myself.

Q. Colonel Scheidenhelm, state whether or not these tests were made under your supervision and direction.

A. They were, entirely so.

Q. State whether or not you have studied and examined the records of the conditions produced by these waves as they passed through the Kanawha River.

A. I have done so in respect to both changes in elevation of water in the respective pools and as regards the maneuvers of the wicket gates in the cases of the eight movable dams.

Q. Please state whether any of the power tides or waves which came into the Kanawha River as a result of the tests of March, 1930, caused any interference with navigation on, or the navigable capacity of, the Kanawha River?

By Mr. THOMPSON. I object.

By the COURT. Objection sustained.

By Mr. JACKSON. Exception. May I ask if that is on the ground of the form of the question or ground of incompetency?

By the COURT. Ground of competency. He has recited all the facts he knows about it, and you have the testimony of other witnesses in here, the Government agents themselves who were down there when the waves came down, and who said it would not interfere.

By Mr. JACKSON:

I realize it is cumulative, your Honor.

Q. Please state, Colonel Scheidenhelm, whether in your opinion, any of the waves produced by the 1930 wave tests, in passing through the Kanawha River, caused any interference with navigation on, or navigable capacity of that river.

By Mr. THOMPSON. Same objection.

By the COURT. Objection sustained.

By Mr. JACKSON:

Exception.

Q. What were the character of the changes, if any, in stream stages on the Kanawha River navigation pools during the wave tests of 1930?

A. The characteristic was the minor extent of the variation and the gradual manner in which those variations occurred. One could stand for hours along the navigation pools and not be

able to observe any change except as after awhile the gauge revealed it.

Q. What would be the effect, if any, of changes in stream stage of that nature on the navigation pools on the Kanawha River, on the operation of a boat?

By Mr. THOMPSON. I object to that. It is getting around to the same question.

By the COURT. Objection sustained.

By Mr. JACKSON. Exception. Is that on the form of the question or competency of the witness?

By the COURT. I expect it is the competency of the witness. Most anyone could tell what effect it would have on a boat as well as Col. Scheidenhelm.

By Mr. JACKSON:

Exception.

Q. Colonel Scheidenhelm, are there any natural tides in New River?

A. There are. Not at this moment perhaps, but they are natural phenomena on New River.

Q. Will you explain what you mean by that?

2638 . A. Well rain tides come in which have much the same characteristics as power tides for illustration, and they occur from time to time with varying degrees of intensity. If there is enough rain or melting snow, the tide can take the form of a great flood. There are variations all the way from that down to minor floods or rain tides.

Q. How do natural tides which occur in New River, compare in magnitude with those which were produced by the 1930 wave test?

A. Time and again natural tides occur which substantially exceed in amplitude and in volume any of the 1930 test tides.

Q. State if you know whether the old wicket type navigation dams on the Kanawha River were and are prepared for natural fluctuations of a magnitude greatly in excess of the fluctuations caused on the Kanawha River by the 1930 wave test.

A. They are prepared to cope with the natural tides substantially in excess of the 1930 series, and for that matter they do.

Q. State whether the waves or tides produced by the 1930 wave test would correspond with a substantial degree of peak operation of the Radford project.

A. They would.

By the COURT. I expect you testified about it, but I didn't catch it. For what length of time was this water released during these tests?

By the WITNESS. Meaning in regard to an individual tide or the whole series?

By the COURT. I mean an individual tide. If you wanted to create a water tide down the river how long would the water run up at Buck dam for an individual wave?

By the WITNESS. (After referring to notes and exhibit.) Exhibit #227 is one which shows the duration in point of time at Ivanhoe.

2639 I do not believe I have with me the precise time of release of the water at Byllesby and Buck, respectively, but they approximate those stated for Ivanhoe. In the case of wave #1, reading the chart by inspection and without scale, it looks like six or seven hours of duration for the #1 wave, or perhaps eight hours, and #2 about the same. When it came to the higher tides, however, the capacity of the Byllesby reservoir was not such as to permit the discharge of the water for so long a period, and they reached a maximum, which was always a point, and then decreased, that is why I said that in the case of the waves which had the maximum amplitude Nos. 15 and 16, and maybe 14–a, that they were not what I would style typical—I doubt if there is anything strictly worthy of the name typical in the series, because there were varying conditions throughout, but certainly those which were released at intervals of about eleven hours were hardly typical of anything that later could occur at Radford, but as to the earlier ones which had durations of from six to eight hours, and some of the others of lesser duration, their maximum amounts were more nearly those that would be typical of conditions at Radford. Have I answered the question?

By the COURT. I think so.

By Mr. JACKSON:

Q. Colonel, to what extent, if at all, have you made any study of the possibility of causing any interference with the navigable capacity of the Kanawha through operation of the Radford power plant or any other power plant up-stream from Kanawha River?

A. I have made extensive studies over a series of years.

Q. And what was the purpose of your studies or the occasion for them?

A. Primarily to determine what should be my advice to the client as regards the safety of constructing and operating power developments which might conceivably be concerned with the conditions on the Kanawha River.

2640 Q. Assuming the Radford project to be in operation and the physical conditions with reference to the navigation

structures on the Kanawha River to be the same as those existing at the time of the 1930 wave tests, in your opinion would it be possible for the Radford project to operate according to some peak carrying method without causing interference with the navigable capacity of the Kanawha River?

A. It would.

By Mr. JACKSON:

Q. Col. Scheidenhelm, assuming the conditions on the Kanawha River with respect to structures, navigation dams and the like, to be the same as those which existed during the 1930 wave tests, state whether, in your opinion, a substantial peak operation of the Radford project would impair the capacity of the Ohio River?

A. It would not.

By Mr. JACKSON. The question was amended to include "navigable capacity", as the Court suggested.

By Mr. JACKSON:

Q. State, if you know, whether the wicket type dams will be in the Kanawha River when the Radford project is completed and ready for operation?

A. They will not.

By Mr. JACKSON:

Q. Would the possibility of affecting navigable capacity of the Kanawha River by any method of operating the Radford power station be greater or less after all of the wicket type dams on the Kanawha River have been displaced by the roller gate dams?

A. Any such possibility would be less after the new Kanawha Roller type dams are in place, including the Gallipolis dam on the Ohio.

Q. Are you familiar with the London dam?

A. Yes.

Q. State whether there is any pondage at that dam?

A. There is.

Q. How is it utilized?

A. There is an available pondage of three feet in depth between elevation 614 and 611 above mean sea level, and it is utilized in routine operation by the Kanawha Power stations of the Kanawha Valley Power Company.

2641 Q. How much pondage is available at London dam?

A. In the neighborhood of 2,700 acre feet, probably something more.

Q. You say there is three feet pondage. What is the elevation of the upper and lower limits of this pondage?

A. The upper is at elevation 614 and the lower at elevation 611.

Q. Do you know where the head of navigation in the project on the London pool is located?

A. Yes, it is at Mile 90.57, above the mouth of the Kanawha.

Q. State, if you know, whether the project depth remains at the upper end of the London pool when it is drawn down to elevation 611?

A. When the pool is drawn down to elevation 611 there is still at least the project depth of 9 feet at the head of navigation.

Q. What, in your opinion, is the importance, if any, of the London pondage as regards re-regulation of fluctuating flows from up-stream?

A. It is important in that it can do it. It is important that it can do it to a substantial degree. In my opinion, it can re-regulate any power tides which conceivably can be propagated at the Radford power project by means of the installation proposed there.

Q. Disregarding the three foot draw down in the case of the London Pool, state, if you know, whether the Kanawha navigation pools are kept at precisely constant levels?

A. They are not.

Q. What is the extent of the variation?

A. The variation is different in degree and in time of occurrence. There is nothing regular about them. In the case of the Kanawha pools the variations have occurred.

Q. Which Kanawha pools do you mean?

A. In the case of the Marmet pool the variations are several inches above the pool level and several inches below. By understanding with the United States District Engineer Office, the variation below pool level is being limited to a .3 of a foot. The limitation I am referring to is the limitation on the part
2642 of the operators of the power stations at London and Marmet stations. However, there are variations which result from the plain inability of operators at Locks and dams, regardless of power stations, to keep the pools absolutely level.

Q. As a matter of practical operation, will there be any fluctuations of a similar character in the Winfield and Gallipolis pools when they are completed?

A. Necessarily so.

By Mr. JACKSON:

Q. Are you familiar with the dams on the Kanawha River?

A. I am.

Q. How long have you been familiar with them?

A. Something like ten years.

Q. Have you seen them from time to time, or not?

A. Yes.

Q. Have you observed their operation?

A. Yes, I have observed their operation and their records, both, as I have them at the office, as they are in the District Engineer's office, and as they are contained in the Lock Master's Offices at the several locks and dams.

Q. I will ask you what are the present conditions as regards variation of pool levels in the cases of pools formed by the wicket type dams still remaining in the Kanawha River?

A. Speaking of the pools generally, that is, without reference to any individual pool, the variations in head water at the given lock and dam, are normally over a range of 18 inches to 2 feet, although there are occasional variations which are substantially greater, especially in the upper direction. The wicket type dams in their operation necessarily result in a dropping of the pool level when the wickets are lowered and that may be to the extent of one foot or more below the pool level as and immediately after the wickets are dropped. On the other hand, wickets once up are not thereafter dropped as a matter of operating practice until the depth of water over the top of the wickets approximates one foot. So far I have referred to the variations
2643 of the head water at the dams in the general case. At the upstream ends of the pools there are still greater variations because of the back-water effect.

By Mr. THOMPSON:

Q. You mean by head water, the upper end of the pool, do you?

A. By head-water I mean the upper level of the water at a given lock and I am referring to it adjacent to the dam and lock, so to speak, and not at the upper end of a given pool, but I did refer to the upper end of the given pool and stated that there the back water effect comes into play and there are still greater variations. In the case of that wicket dam pool which is immediately down stream from the Marmet dam, the variations at the downstream end of the pool, that is, the head-water at Lock and Dam #6, does not differ in its performance substantially from what I have related as an average condition at the existing six wicket type dams, but at the up-stream end of that pool the variations due to the operation of the Marmet power station result in variations which, in amplitude, are greater than probably exist at the downstream dams in respect of the up-stream ends of their respective pools.

A. The variation in the head of the #6 pool is the same as the variation in the tail-water of the Marmet Power Station and the variation there extends to approximately 3 feet above the #6 pool level. I am referring to a variation caused by the power station.

By Mr. JACKSON:

Q. Please state what, if any, effect these fluctuations in pool levels of the London and Marmet pools and future Win-
2644 field and Gallipolis pools will have upon any fluctuating flows into those several pools?

A. I have referred to two kinds of variations, one of a few tenths above and below the pool level, and the other variations being of the order of several feet in the wicket type dams. Am I to understand that counsel's question refers to those of several tenths above and below the normal pool levels?

By Mr. JACKSON:

Q. Yes, it is confined to the London, Marmet, Winfield and Gallipolis pools?

A. In that respect the result will be to even out any fluctuating inflows into any of the given pools, and to reduce the variations of out flow as compared with the variations in inflow.

Q. State to what extent, if any, in your opinion, these fluctuations last described by you would re-regulate any conceivable power tides from the Radford power station?

A. In my opinion it would even them out to such an extent that the flow passing the Gallipolis dam could not reveal any variations due to variable inflow into the London Pool and that might, and probably would, be true in the case of the Winfield dam and, to a lesser extent, in the case of the Marmet dam. One can't tell precisely at what point the variations would become indistinguishable but by the time the relatively large pool areas of the Winfield and Gallipolis dams are brought into play and the very minor fluctuations in those pools taken into account, there can, in my opinion, be no residual variation from any power tide which the Radford project could conceivably cause in the London pool.

By Mr. JACKSON:

Q. What, in your opinion, will be the effect, if any, of the operation of the London, Marmet and Winfield power stations upon any power tides that might reach the Kanawha River from the Radford station?

A. The variations in flow through the respective power stations on the Kanawha River, varies to so great an extent that any residual power tides and variations due to power tides from

the Radford station simply would not be recognizable and could not have any effect downstream from the London power station.

2645 Q. When you speak of fluctuations in flow caused by the operation of the London and Marmet power stations, can you state how those fluctuations, resulting from the operation of the London and Marmet power stations, compare with any power tides which could conceivably pass into the London and Marmet pools from the Radford station?

A. Well, the upper limit of any power tide from the Radford station would be an absolutely undiminished tide from that station, that is undiminished in amplitude in second feet, something which, in my opinion, is just impossible of occurrence. If it did, it would have an amplitude which would be slightly less than the discharge capacity of the London and Marmet power stations and substantially less than the discharge capacity of the Winfield Power Station. However, the variations which can be due actually, in the London pool, to any power tides propogated at the Radford station, assuming absolutely no re-regulation enroute, or in the London pool, would be of an order of less than half of the discharge capacity and hence of the variations in flow at the London Power Station and the others down-stream.

Q. In the first part of your answer, you said that if there was no change in a power tide between the time it left Radford and reached London Pool. I didn't understand that statement.

A. If there were no reduction in amplitude in a tide with the result that it caused a variation of 9,000 second feet.

Q. In your opinion is it possible for a tide discharged at the Radford Power Station to come down to the London and Marmet pools without any reduction in amplitude?

A. Absolutely out of the question.

Q. In your statements with reference to the comparative potentialities of fluctuations in the London or Marmet pools from Radford power waves and the fluctuations produced by operations of the London and Marmet stations, did you limit your opinion to the amplitude of variations in flow represented by the power tides themselves?

A. When I stated that the variation in discharge out of the London and Marmet and Winfield power stations would

2646 very greatly exceed the possible variations in any power tides from the Radford station, I had in mind the actual variations which might occur, on the assumption, however, of no reregulation either enroute or in the London pond.

By Mr. JACKSON:

Q. That is not what I am getting at, Colonel. Are there such things as secondary variations?

A. There are.

Q. I want to know whether in your answer about the comparative fluctuations resulting in these pools, you took into consideration the question of secondary variations?

A. I did not. If I were to make a comparison on secondary variations the ratio would be far different, I think secondary variations would be so insignificant from the power tides propagated at the Radford station that it just would not enter the picture at all, whereas, secondary variations due to the operations of the London, Marmet and Winfield stations would be perceptible, entirely so, as those due to London and Marmet now are.

Q. Colonel, have you made any investigation of leakage through the London or Marmet dams and locks?

A. I have.

Q. What do you estimate the requirements needed to offset leakage at the London and Marmet dams and locks?

A. A total, under present conditions, for the locks and dams at each site of about 40 second feet, not over 40 second feet, per site, probably more nearly 30 or 35 second feet. However, after making some allowance for wear of the seats of the gates at locks and dams prior to a period of renewal or repair, I would say an allowance of 50 second feet should cover the total at each site for dam gates and locks.

Q. Have you made any investigation of the water requirements for lockages at the Marmet and London dams?

A. I have.

Q. What, in your opinion, is the water requirement for lockages at the Marmet dam under present conditions?

A. Not over an average of 50 second feet.

2647 Q. In determining the minimum water requirement for keeping the new navigation pools on the Kanawha River filled, what factors need to be taken into account?

A. The leakage through dams and the lock gates, the requirements for lockages in the sense of emptying of lock chambers, the leakage under or around the dams including the power stations as dam structures, any leakage through the gates, including the turbine gates of the power stations, and evaporation.

Q. Assuming a critical low flow season and no flow allowed through locks, dams or power stations excepting such as is necessary for lockages, what, in your opinion, would be the minimum requirement of water to maintain the new navigation dam pools under present conditions?

A. Between 135 and 150 second feet.

By Mr. JACKSON:

Q. What were the number of lockages last year?

A. May I refer to my data?

A. The total lockages at the Marmet dam for the year ending une 30th, 1936, was 2640, of which close to one-half were lock-ges for the purposes of dredging operations, which were un-sual in quantity. Down to Lock 8——

By the COURT:

Q. What dam?

A. Marmet dam, sir.

By Mr. JACKSON:

Q. You say "unusual." Did that have anything to do with onstruction or not?

A. I cannot say positively that it had to do with construction, ut in my opinion, they were, yes, sir.

Q. Proceed.

A. Now, the total number of lockages does not represent the otal number of emptyings of lock chambers.

It is a common practice of the Engineering branch of the War epartment to assume a figure of .75 for that purpose, that is, o assume that, out of the total number of lockages, ¾ths of that umber will be or represent emptyings of lock chambers. How-ver, the practice is not the same throughout all the branches of the service, and at the Huntington office, apparently the 348 figure .85 is used for that purpose, and I have so used it.

In consequence, the average number of lockages, without aking any deductions for special lockages on account of dredg-ng, would have resulted in an average number of emptyings of he lock chambers in the amount practically of Six per day. I ssumed an average of Seven.

Q. What is the volume of water required per lockage per day t the Marmet dam?

A. The volume of water required per lockage per day: The olume of water involved in single emptyings of lock chambers, ith the pools at their normal levels, that is, both head and tail ool, is approximately Six second foot days.

Q. Will you state how many lockages last year were for redging and how many lockages there were for ordinary travel?

A. In that year at Marmet, there were 1,232 lockages for redging; there were 70 lockages on account of construction of he locks themselves, or of the hydro-electric stations, and 1,338 ockages for ordinary traffic.

Q. Assuming the doubling of the number of lockages for last ear, what would be the total requirements, with the other con-

ditions remaining the same—that is, the ones stated in answer—in connection with the previous question to you, to-wit: no flow allowed through the locks, dams or power stations, except such as is necessary for lockages?

A. Doubling all of the lockages, both for ordinary traffic and for special and temporary purposes, I would estimate that the total water requirements for maintaining the pools full, would be between 175 and 200 second feet.

Q. What, in your opinion, would be the reasonableness of assuming the doubling of the lockages for dredging?

A. In my opinion, that is far from reasonable. There is no sound basis for it.

Q. State whether or not, in your opinion, any power tide from the Radford power station will be perceptible in the Ohio River down stream from the Gallipolis dam?

A. In my opinion, it will not be perceptible.

Q. State whether or not, in your opinion, it is reason-
2649 able or unreasonable to assume that the flow past the Radford dam would be cut off during the low water season for several weeks or longer?

A. It would be very unreasonable to make such an assumption.

By Mr. JACKSON:

Q. Assuming, nevertheless, that the flow of New River at the Radford dam or power station is completely cut off for a period of indefinite length, and that the London, Marmet, Winfield and Gallipolis dams are completed and in operation, in your opinion, would such a condition prevent the maintenance of the navigation pools on the Kanawha River?

A. It would not prevent the maintenance of the navigation pools on the Kanawha River, at their normal level.

Q. And give us your reason——

A. Well, the cutting off of the flow at the Radford dam site completely would, of course, remove the contribution of that portion of the drainage area, and there would remain solely the run-off or contribution from the drainage area downstream from the dam site. Under the lowest bases of estimate of the residuary flow from the down stream area, which would obtain at Kanawha Falls or points down stream, there would be, roughly, twice as much water as in my opinion, would be necessary for maintaining those pools at their levels—at normal levels. In that connection, I am taking into account the average monthly flows, rather than the occurrences of a day or two, because, in such a period, what happens upstream on a given pair of days, for instance, cannot be a true measure of what will happen down-stream on the two days, or in the ensuing two days, even

fter making all the allowances for lag. Put in another way, he water that originates upstream, in any given two days, will not n two days pass—will not within two days pass any given own-stream point, as long as there is any variation in flow. Necessarily, if there are any two days, which, on the Kanawha River are the subjects of estimates of especially low flows, the ows adjacent to these days are greater.

In other words, there is a variation of flow and it is just improper to attempt to match up any two days of the Kanawha flow, under these conditions, with any two days upstream, and the same is true of any other group of days, until one gets into a broader area than a few days.

Roughly speaking, throughout the low water period, the minimum excess of flow from the drainage area downstream from he Radford project would be on the order of 100%.

Q. Turning from that hypothesis, which supposes the flow cut ff from the Radford plant during the low water season, state n your opinion what would be the actual effect of the operation f the Radford project, as regards the flow in the Kanawha River, during low water period?

A. It would substantially increase the low water flow into the Kanawha River.

Q. State whether or not that effect would extend into the Ohio River?

A. It would necessarily extend into the Ohio River, yes, sir.

Q. Please state what was the flow of Little River at its mouth hroughout the month of October, 1930?

A. (Examines papers.) Based on the estimate of the flow for Little River, at made by the United States Geological Survey for Graysontown, Virginia, for that month, and in the light of my nowledge of the situation generally, I would say that the flow f Little River, at its month—

A. its mouth—throughout October, 1930, approached in the eighborhood of 135 second feet.

Q. Colonel Scheidenhelm, you have expressed a number of pinions regarding the possible effect of the Radford power station on the Kanawha River. In expressing those opinions, did ou take into account any possible reregulation of the Radford ower tides between the site of the Radford project and the Kanawha Falls?

A. I did not.

Q. This morning, you referred to what you described as the Bluestone power project of the West Virginia Power Company. Will you briefly describe that project?

A. (Witness examines papers.)

A. The Bluestone power project of the West Virginia Power Company, with its two stages of development, named Hin-
2651 ton and Bulls Falls, respectively, would have installations as follows:

At the Hinton development, 22,500 kilowatts or 31,500 horsepower. At the Bulls Falls development, 120,000 kilowatts, or 170,000 horsepower. That is, the total installation in the two stations, in the terms of horsepower, would be 200,000 horsepower.

The Bulls Falls development is intended to empty into the Hinton reservoir—that is, empty the power discharge of the Bulls Falls power station into the Hinton reservoir, which reservoir is to have a fluctuating water surface and relatively uniform discharge.

In other words, the Hinton development is intended to be a reregulating development. The Bulls Falls development is a combined storage and power development.

Q. Why did you recommend this form for that project?

A. Because in the case of a large power development, with great capacity, located at the head of a very steep portion of the river, and in proximity to downstream riparian owners, and in proximity to navigation works on the Kanawha River, as they existed at that time—at the time that I made the recommendation, it was my opinion that the West Virginia Power Company should not take the risk of being subject to liability for interference, or claims for or liability for interference with these riparian rights or with the navigation structures on the Kanawha River.

Q. As I understand you, this has been changed, under your supervision, from an earlier project of single stage to two stages?

A. That is true.

Q. Was the change from the single to the two stage development of the Bluestone project, brought about or affected in any way, by any proposed method of construction of the Radford project?

A. It was not.

Q. What is the present status of the Bluestone project of the West Virginia Power Company?

A. The status of development or the progress in the direction of consummation is, that the West Virginia Power Com-
2652 pany owns the dam sites and owns lands and rights of approximately one-fourth of the total necessary. In 1929 and 1930, steps were taken, by way of intensive explorations and planning, looking towards early construction, and previously pending application for a license before the Public Service Commission of West Virginia, on the part of the West Virginia Power

Company was amended so as to cover the change from a single high dam development to the project that is shown on Exhibit No. 600.

That Application was pending before the Public Service Commission of West Virginia for some months; hearings were held but before the Commission made a decision with respect to the issuance of the license the Supreme Court of Appeals of West Virginia declared unconstitutional that Act under which the Public Service Commission of West Virginia was operating, in respect to water power development.

Q. State if you know whether or not this Bluestone project of the West Virginia Power Company is still included in the plans of the defendant and its affiliates with the developing of power stations on New River?

A. Yes, sir. The only condition under which I can conceive that it could not be brought into being, would be for the Bluestone reservoir project recommended by the Chief of Engineers, or some other form which might be approved by Congress, to be constructed.

Q. From the standpoint of any possible effect of the Radford project or the effect of the Radford project on the development of the Bluestone site, does it make any difference whether or not the so-called Bluestone project be constructed in accordance with the plans of the West Virginia Power Company, or in accordance with the plans which have been set out by the Government, in Exhibit No. 145?

A. I believe it makes no difference in respect to the effect of the Radford project on the Bluestone project, if I understand the question correctly.

Q. Yes, sir.

By Mr. THOMPSON. What do you mean by that? The
2653 effect so far as the flow of water is concerned, or whether or not you go ahead with the Radford project?

A. I assumed the question to mean an effect upon the operation of the Bluestone project.

By Mr. JACKSON:

Q. What I want is whether or not the effect upon any possible power tides from Radford will be materially different, if the so-called Bluestone project be constructed in accordance with the plans of the West Virginia Power Company, instead of in accordance with the plans of the Government, as shown in Exhibit No. 145?

A. That puts the situation in the converse of what I understood the situation to be. My answer is, in that latter respect, the effect of either the Bulls Falls development of the West Virginia Power

Company's Bluestone reservoir project, or the Bluestone project of the United States, will each have the same effect upon the power tides from Radford.

Q. What will that effect be?

A. That effect will be essentially to make them lose their identity; in effect, to re-regulate these power tides so that they will not be recognizable and not appear as such down stream at Bulls Falls or Bluestone dam respectively.

Q. Are you familiar with the revised plans for the Radford project, shown in Government Exhibit 90–A?

A. I am.

Q. State whether or not the Radford project is now being constructed in accordance with those plans?

A. It is.

Q. I think you have testified that you are familiar with the power developments at the Government navigation dams on the Kanawha River?

A. Yes, sir.

Q. In your opinion, what, if any, effect will the construction and operation of the Radford project have upon the value of the power of the Government navigation dams on the Kanawha River?

2654 A. Its effect will be beneficial upon the value of the power.

By Mr. JACKSON:

Q. Assuming the Government constructs the Bluestone project, what effect, if any, will the construction and operation of the Radford project have upon the value of the power to be developed at the Government Bluestone project?

A. In my opinion, it will have a very substantial beneficial effect upon that project.

By Mr. THOMPSON:

Q. That Radford will have on Bluestone?

A. Yes.

Q. Will you give your reasons, please?

A. The principal element affects both the Bluestone reservoir project power and the Kanawha River navigation dam power, and that is the increase in the low-water flow at each of those sites. The increment in flow being roughly 600 second-feet over the low-water flow at Radford is a constant increment, and it has a larger ratio to the low-water flow at the Bluestone site than to the flow of Kanawha River at the several navigation dams. Therefore, the proportionate benefit will be greater at the Bluestone site than downstream, but in each case it will be beneficial.

The increase in low-water flow, however, is not the only benefit. The fact that the Radford storage reservoir would be filled out of high flows and flood flows means that to that extent there will be less water in floods at points downstream. That has no great bearing on the power available to be developed at the Bluestone site, but it does have an effect at the navigation dams. That is because the power stations at the navigation dams are all relatively low head, and from time to time the head becomes such as to put the power plants out of operation—that is, when the head drops sufficiently, the power stations at London, Marmet, and Winfield cannot or will not be able to operate, and the period of outage will be decreased by reason of the waters put into storage from time to time in the case of the Radford development.

By Mr. THOMPSON:

Q. That was on the assumption that the Bluestone was not built?

A. The statement holds good as I have sought to dis-
2655 tinguish it, regardless of Bluestone—that is, the storage of Radford is effective with regard to the Kanawha navigation dams, whether or not there is a Bluestone development.

By Mr. JACKSON:

Q. State, if you have not already covered that, whether the Kanawha Valley Power Company relies upon capacity in the terms of power installation of the London and Marmet projects during low water flow?

A. Of course the Kanawha Valley Power Company does and it has been able to enter into a contractual relation with the Appalachian Electric Power Company in the light of that condition.

Q. You just stated in times of high water, I believe, that these power stations at London and Marmet are temporarily out of service; that is right; isn't it?

Q. Temporarily out of service during certain high water conditions. I might add that their capacity is reduced at lesser high flows, even though they are not completely out of operation. Any rise in tail water of those stations cuts down the head, and, therefore, the power capacity at the Kanawha navigation dams.

Q. Well, when high water obtains on the Kanawha River to such extent as to temporarily prevent the operation of the London and Marmet hydroelectric stations, what would be the probably condition of power availability at the Radford station?

A. At that station the probability would be a relatively high flow, and, therefore, a relatively greater available power output.

Ordinarily, under those circumstances, the reservoir would be full and the station could be running to the full capacity of 9,000 second-feet or 10,000 second-feet without any wastage. To be sure the tail water at the Radford development would rise somewhat, but that rise, compared with the total head, is minor and would be far more than offset by the increase in the available flow through the power station.

Q. Would that permit the Radford station to make up any substantial part of the power loss by reason of the London and Marmet stations being out of operation?

2656 A. It would serve as a general effect in respect of loss of power supply at that particular time for the system as a whole.

Q. State whether or not what you have said about the operating limitation of the London and Marmet power stations will be applicable to the Wingfield station?

A. That will be essentially so.

Q. Col. Scheidenhelm, in your capacity as Consulting Engineer for the Radford project, did you have anything to do with the determination of what lands and the extent of lands which should be acquired?

A. Yes, I advised throughout in that respect after I became identified with the company and the project, about 1925.

Q. Have your duties as Consulting Engineer required you to maintain familiarity with the amount of land required for the project?

A. Yes.

Q. Will you please state how much land has been acquired by the defendant for the Radford project—just in round figures?

A. The company has acquired all of the land to be overflowed.

Q. How much is that?

A. That totals approximately 5,000 acres.

Q. Will you state, if you know, the cost of acquiring these lands and property rights to the defendant?

A. I do not know the precise amount, but it is over one million dollars.

Q. Has anything been spent in exploratory or other work preparatory to construction?

A. Yes, substantially over quarter of a million dollars have been spent for that purpose under my direction.

Q. Has anything been spent on construction?

A. Yes.

2657 Q. How much, approximately?

A. I am not familiar with the details in that respect, but I know it is again substantially in excess of a quarter of a million dollars—probably nearly half million dollars.

Q. Will you state, if you know, what was the purpose of expenditure in acquiring these lands on which the Radford project is being constructed?

A. The object was to acquire them for that particular power development.

Mr. THOMPSON. Is he speaking as agent or representative of the company, or as Consulting Engineer?

Mr. JACKSON. As Consulting Engineer.

Mr. THOMPSON. In buying land.

By Mr. JACKSON:

Q. Please state, if you know, whether the defendant has any use for the land so acquired other than for the development of this water power?

A. It has not.

Q. Have you ever made any appraisals of hydroelectric power sites?

A. I have.

Q. Have those appraisals included the valuation of lands used or suitable for use for the development of hydroelectric power?

A. They have.

Q. In the course of your professional work, have you had any occasion to make any such appraisals for banking or investment houses?

A. Yes, sir.

Q. And in the course of your professional work have you become familiar with the values of lands adapted for development of water powers?

A. I have, in the cases of individual developments and in the broader sense have become familiar with the values of power sites as such, including the lands and rights comprising them.

2658 Q. What effect, if any, in your opinion, would be the inability of the defendant to develop its property at the Radford site for water power purposes, without subjecting the property to recapture by the Federal Government, under the terms of the Federal Water Power Act, and without subjecting the operations to the other requirements of the Federal Water Power Act, have upon the marketability or value of the property now owned by the defendant at the Radford dam site?

A. In my opinion it would substantially reduce or depreciate the value, and because of that would undoubtedly affect the marketability of the lands for the purpose of power development.

Q. Col. Scheidenhelm, are you familiar with the plans for the Government Bluestones project as they are set out in Government Exhibit #145?

A. I am reasonably so.

Q. Please state whether those plans do or do not provide for any peak load operation of the Government Bluestone power station?

A. In my opinion the description of the proposed operation of the power portion of the Bluestone reservoir project necessarily imply substantially peak carrying operation.

By the COURT. It is a fact this Bluestone project contemplates the regulated flow of not less than 2,000 feet a second. Does that in any way interfere with or modify its operation for power purposes.

By the WITNESS. My opinion, as expressed in my previous answer, and as bearing upon the answer to your Honor's question, is affected largely by the statements contained in paragraph #65 of page 116 of House Document #91. If the words "minimum regulated flow of 2,000 cubic feet per second" stood by themselves one could not tell whether or not it was contemplated the flow would be uniformly 2,000 second-feet throughout the low water season, or whether there was involved some degree of variations within a day or a week, or otherwise, but main-
2659 taining the average of 2,000 second-feet through the day or otherwise—my interpretation of that particular paragraph of the report is that it contemplates a variation at least within the twenty-four hour period. The wording there is very clear in its significance to me in that respect, but I am not ready to say it contemplates a variation outside of a given twenty-four hours. That might or might not be the case.

By the COURT. It seems to me the Radford project and the Bluestone project, from the standpoint of operation for power purposes in the nature of the load they will carry, are essentially the same kind of project, both with a high head, and look to me as though they would be operated the same way and meet the same demands, excepting insofar as this regulated flow of not less than 2,000 second-feet might affect that. Hasn't it been testified here it is contemplated at Bluestone there would be an installed capacity of something like 10,000 second-feet?

By the WITNESS. 11,000 under maximum flow conditions.

By the COURT. All right, that would indicate to me it was exactly the same sort of power development that would be operated at Radford, substantially the same, and carry the same sort of general scheme of an electrical power system. I am wondering how far that is affected or modified by the requirement for regulated flow of not less than 2,000 second-feet?

By the WITNESS. If it were specified that that regulated flow should be uniform then that might be controlling, but it would be inconsistent from the technical engineering standpoint, with

the statements made elsewhere in the report and in that particular paragraph on the question of uniformity or variability of discharge from the power station, but there are various statements in paragraph 65 which lead me to the inescapable
2660 interpretation for myself that the operation of the plant is intended to be on a varying basis, such that approximately two-thirds of the total output would be developed within one-half of the twenty-four hours of the day, and the remaining one-third within the other one-half.

Q. When you refer to paragraph 65 is that on page 116 of Exhibit #145?

A. Yes, sir.

Q. I want to invite your attention to statement on pages 2 and 3 of Government Exhibit #145 (reading): "On the New River and its tributaries the plans provide for a series of dams with a storage reservoir capacity of nearly 1,400,000 acre-feet, the utilization of upward of 2,000 feet of head, and the development of 454,000 primary horsepower or nearly 1,500,000 primary peak horsepower at 30 percent load factor."

I will ask you what that means in terms of an engineering method of operation?

A. Well the reference to 454,000 primary horsepower is clearly to the continuous power which could be obtained during the lowest flow seasons with the benefit of all available storage year after year. It represents the power which would be available if the regulated flow were utilized uniformly. By analogy, referring to the question the Court propounded, a few minutes ago, it would correspond with the power which would be developed from the Federal project at Bluestone if the 2,000 second-feet of regulated flow were used uniformly; however, coming back now to the sentence in point, at the foot of page 2, or top of page three, of House Document 91, it is evident from the remainder of the sentence it is not proposed to use the regulated flow uniformly. Rather it is proposed to develop 1,500,000 primary peak horsepower. The words "primary peak horsepower" mean that that equivalent uniform or continuous horsepower of 454,000 would be utilized on a peak carrying or variable basis,
2661 such that the maximum output would be not 454,000 but rather 1,500,000 horsepower. The ratio of 454,000 to 1,500,000 is approximately 30%, and that interpretation is borne out by the reference in the last few words of the sentence "30 percent load factor."

Q. Does the term "primary peak horsepower" mean that is the amount of horsepower that would be dependable available through part, or only part, of each day?

A. It represents the maximum peak power point which it would be proposed to yield.

Q. I direct your attention to paragraph 10 on page 3 of Government Exhibit #145, where it refers to plans on the main stem of the river, which says (reading): "* * * the regulated flow of the tributaries would afford at the Kanawha Falls plant and
2662 the three navigation dams a total of 51,000 primary horsepower or about 123,000 primary peak horsepower at 41 percent load factor."

I will ask you what that means in terms of engineering operation?

A. It has the same significance as in the sentence which you previously read, that is the minimum regulated flow, whatever it might be was assumed to be used uniformly if there were to be derived from it 51,000 primary horsepower, but if there were to be derived from it 123,000 primary peak horsepower it would necessarily not be used uniformly, and the result would be the peak load developed from that same water would be about 2½ times the average power output or load.

Q. According to the method of operation as indicated in Government Exhibit #145, how much variation might occur during the course of a single day in a discharge from the proposed Government power installation in the Bluestone dam?

A. Well, during the low-water season the variation might be from zero to about 10,000 cubic feet per second. During periods of higher flow the variation would be presumably from a flow somewhat in excess of zero up to a maximum of 11,000 cubic feet per second.

Q. Colonel Scheidenhelm, assuming a 4½ foot rise in the river above normal at Radford, please state what proportion of the time such a stage would obtain at Radford?

By Mr. THOMPSON. That is at the dam site?

By Mr. JACKSON. No, at Radford, not quite the dam site.

By Mr. THOMPSON. You mean at the City of Radford?

By Mr. JACKSON. Yes sir.

A. The question arises as to what is normal flow, and as to that I can show two figures within which I would think that normal flow would lie. If I assume that normal flow at Radford corresponds with a flow of 1,000 second-feet at the Radford
2663 dam site then 4½ foot stage above normal would be available about 1½% of the time on the average, or an average of about 5½ days per year.

If, on the other hand, I assume normal flow at Radford corresponds to 2000 second feet at the Radford dam site, then a 4½

foot stage above that normal stage would be available 1 2/10% of the time, or about 4½ days on the average, I believe, per year.

Examined by Mr. JACKSON:

Q. Col. Scheidenhelm, is either the Byllesby or Buck dams and power stations operated under Federal license?

A. Neither of them is operated under Federal license or permit.

Q. When did the defendant, or its predecessor, commence the acquisition of land for the Radford dam site—how long ago?

A. About 20 to 25 years ago.

Q. During the course of the cross-examination of Mr. Gerdes, there was identified a sheet entitled "Maneuvers of dams on the Kanawha River during wave tests, 1930," marked "Defendant's Exhibit 543 for identification." It was our understanding that Mr. Gerdes retained that sheet marked for identification, and they think that we have it. We have a sheet which is agreed to be correct, subject to check, to be marked "Defendant's Exhibit 543."

(Exhibit 543 offered in evidence.)

2664 By Mr. JACKSON:

Q. Col. Scheidenhelm, will you please state if wave No. 10, of the 1930 tests, was affected by any maneuvers on the dam?

A. Referring to Exhibit 228, and in particular to the course of the wave which is numbered rather lightly in that exhibit as No. 10, there were, on March 23, 1930, two maneuvers of dams on the Kanawha River which affected that wave in its passage at Dam No. 6 and Dam No. 7, respectively.

At Dam No. 6, on March 23, there were raised fourteen wickets between 8:30 and 9:30 A. M. At Dam No. 7 there were raised twenty wickets at about 10:30 A. M.

By Mr. JACKSON:

Q. What was the effect of that maneuver on the amplitude, if any?

A. In each case the effect of the raising of the wickets was to raise the headwater at the respective dams, and, thereby, to increase the gage reading, and thereby to increase the plotted amplitude in stage for the given wave No. 10, and thereby also to increase the correspondingly deduced amplitude in cubic feet per second.

Q. Col. Scheidenhelm, is the slope of New River in the immediate vicinity of the Radford dam site comparatively steep or comparatively flat?

A. It is comparatively flat. At the Radford dam site there is one of the longest pools on the river. From the head of Ingles

Rapids, going in an upstream direction past the mouth of Little River, past the dam site, past Dunkard's Bottom and on to the foot of what was formerly called Moore's Gravel, the river is comparatively a single pool with a length of something over three miles. When there is a flow somewhat above average, the pool condition extends the greater part of a mile further upstream—that is, to the foot of the rapids at Falls Branch, on what is called the Howe place, and is shown on Defendant's Exhibit 545.

Q. What is the longest or flattest pool?

A. Around the Horse Shoe Bend and terminating somewhat down-stream from that point at the head of Sifford's Falls, there are two long pools which have a total length of about ten miles. The five mile stretch up-stream from Sifford's Falls is the flattest portion of the river—that is between the North Carolina line and its mouth. There is probably nothing further up-stream that is any flatter.

Mr. JACKSON. Your Honor will recall that counsel are trying to get certain information which, if it can be obtained, I may want to ask Col. Scheidenhelm to comment on briefly. I will confer with counsel about the status of that.

The COURT. You say that is all?

Mr. JACKSON. Yes, sir.

By the COURT:

Q. You touched on one subject I want to inquire about. You were asked whether the Buck and Byllesby projects had been constructed under Federal license.

Mr. JACKSON. Yes, sir.

By the COURT:

Q. I would like to ask whether they were constructed under authorization of the Secretary of War and Act of Congress?

By Mr. JACKSON:

Q. Are you familiar with that?

A. Yes, sir.

Q. What is that fact?

A. They were not authorized in any form by the Federal Government.

Q. There was no Act of Congress?

A. There was no Act of Congress under which these dams were built. There had been Acts of Congress at earlier times.

Q. Was there any permit from the Secretary of War?

A. There was not.

By the COURT:

Q. Is it a conceded fact that the Federal Government has never made any effort to have removed the Buck and Byllesby dams as affecting navigability of the Kanawha River?

A. The fact, as stated by the Office of the Chief of Engineers and subsidiary officers in the field is that it was brought to the attention of the Chief of Engineers that those dams had been constructed without any permit, and there was ensuing correspondence, the details of which I do not know, although they are contained in a Senate document, No. 15. I do not recall the number of the Congress or the session, and nothing further was done about it. The fact was definitely known to the Chief of Engineers.

By Mr. JACKSON:

Q. I think it will be conceded that no steps were taken to remove the dams?

A. Certainly within the records of the power company, there is nothing to the effect that any step was taken.

The COURT. Does the record show the fact that any application had been made for the removal of this dam as affecting the navigable capacity of the Kanawha River?. I inquire from the standpoint whether the Federal Government has ever abandoned the question of navigability. What I had in mind was the question of the present good faith of the Government in asserting that these dams are obstructions to navigation.

There is one other question which I think ought to be made a matter of evidence before you finish, either by concession or by formal proof, and that is whether or not this proposed project, the subject of litigation, requires the use of land or other property of the United States Government.

Mr. JACKSON. I will ask about that.

By Mr. JACKSON:

Q. Col. Scheidenhelm, you testified yesterday about the lands that had been acquired for this project: Please state whether or not any part of the project will involve the use of any land or any other property of the United States?

A. No land of that character will be involved.

Q. Does the defendant own all lands that are to be used for the project?

A. The defendant owns all the lands which will be overflowed by the Radford dam.

Q. On which any of the dam will rest, or the power site will rest?

A. At the dam site it owns a substantial amount of additional land extending out from the dam, to provide for area for construction purposes, and likewise downstream from the dam in connection with the quarry which will be used in supplying the rock for the construction of the dam.

By the COURT:

Q. Does the Federal Government own any other property which will be involved in this?

A. None within my knowledge, and I am absolutely sure it does not.

Q. Do you know, Col. Scheidenhelm, whether the conveyances of land along New River in the vicinity of this project (any ordinary conveyance from one citizen to another) run from center of the stream or to the edge?

A. They run variously.

By the COURT:

Q. It may be variable in that matter?

A. Yes. Some refer to the river as the boundary, and others more specifically.

By Mr. JACKSON:

Q. You have seen the conveyances, have you not?

A. I cannot say I have seen all of them, but I have seen a multitude of them.

CROSS EXAMINATION

By Mr. THOMPSON:

Q. Colonel, you served during the war, did you not, with the United States Army?

A. I did.

Q. You are not in the United States Army now, are you?

A. Not except in the sense that I am a commissioned officer of the United States Army Reserves.

Q. And do I give offense when I address you as "Colonel" or not?

A. I hope you would not give me offense, no matter how you addressed me.

Q. I was reading the record over, and I apparently gave counsel offense yesterday, and I was trying to figure out how or why I gave offense, and I do not know how.

A. I have heard you pronounce my name differently from what it is pronounced.

Q. It was not any question of detail. It was my pronunciation.

A. I cannot speak for counsel.

Q. I believe you said that you became connected with the defendant company in about the latter part of 1925?

A. I do not believe I stated the latter part of 1925.

Q. Well, about what part of 1925?

A. I haven't looked it up, but my impression is that it was the early part of 1925.

Q. And when you did become a representative of the company, it was necessary, or you did visit the offices of the Federal Government in Washington quite frequently, did you not?

Mr. JACKSON. I object to the question as it assumes that he became a representative. I do not know what he means by that. If he means that he became engineer, it is satisfactory.

The COURT. He stated his connection with it—I think as Consulting Engineer.

A. As regards this particular project, I did not, immediately upon being retained by American Gas & Electric Company, by itself and subsidiaries, come into contact with the Radford project. I do not recall at the moment just when was the first time that I did get into touch with this project, but it was not for months afterwards, nor, I believe was it within 1925.

By Mr. THOMPSON:

Q. Were you retained by the American Gas & Electric Company or by the Appalachian Electric Power Company, or by the Appalachian Power Company?

A. Originally by the American Gas & Electric Company.

Q. And do you represent the American Gas & Electric Company now?

A. I served it as Consulting Engineer.

Q. And you are on a retainer with it, are you not?

A. No.

Q. You do special work and are paid by it; is that it?

A. Yes.

Q. And are you regularly retained by the Appalachian Electric Power Company?

A. Not in the sense of a retainer, as we know it in the engineering profession.

Q. Are you a stockholder in the Appalachian Electric Power Company?

A. I am not.

Q. Are you a stockholder in the American Gas & Electric Company?

A. No.

Q. Or any of the affiliates of either company?

A. No.

Q. Now, you did have frequent dealing, did you not, with the Federal Water Power Commission?

A. I had frequent dealing with the Federal Power Commission.

Q. You were always received courteously there, were you not?

A. If there was any discourtesy, I do not recall the particular time.

Q. The Commission let you go through its files, did it not, from time to time?

A. Not in that sense, no.

Q. Didn't it submit its files to you so you could go through them and look them over?

A. With regard to the Radford project——

Q. (Interposing.) Of course, I mean the Radford project.

A. (Continuing.) There was placed before me at one time a file of correspondence and other matters with regard to the project, but, at that time, there was definitely withheld another file, the precise detail of which I do not know, and that I have never seen.

Q. Did that have to do with the Radford project—the one which you say was withheld?

A. Yes.

Q. You know, don't you, Mr. Fraser Horn, of counsel for the defendant, has gone over the files and has had copies made of the papers in the Radford project matter?

A. So far as I know, and I believe I know the complete fact, he saw the same files that I did, and was refused access to the same file to which I was refused access.

Q. Can you give any idea of any files you have been refused access to?

A. My recollection is that it was a technical file which may have had a name dealing with the word "Fluctuation."

Q. Was it the wave study file?

A. I did not see the file.

Q. Then you have also, during this time, had access, have you not, to the files in the office of the District Engineer at Huntington?

A. No.

Q. You have been there many times, have you not?

A. Yes.

Q. You have always been received with extreme courtesy, have you not?

A. Certainly with courtesy.

Q. And they have let you copy and photostat documents in there, have they not?

A. Certain of them.

Q. Have they ever refused you any information which you have asked for?

A. Yes.

Q. What?

A. I do not recall specifically.

Q. Is that the one that was brought up here by Mr. Jackson in his statement to the Court?

A. Oh, no. Time and again at the Federal Power Commission, at the office of the Chief of Engineers, and at the office of the Division Engineer, and at the office of the District Engineer, the statement would be made, and quite properly so, that the matter was such that they could not show it to me.

Q. All the matters that were proper to show, they did show you, didn't they?

A. That would be for them to say. I don't know.

Q. Has there been any refusal, you know of, of a right that you had as a citizen?

Mr. JACKSON. I object to that question.

Mr. THOMPSON. I am practically repeating your words in your statement you made before the Court.

The COURT. Let him answer.

Mr. JACKSON. Exception.

A. I presume you mean a right which I had to correspondence or documents in any of the offices?

By Mr. THOMPSON:

Q. Yes.

A. Yes, I think so.

Q. Can you give us one or two examples? I am referring now particularly to the Radford matter.

A. Well, I just have impressions, not having searched my memory or my own records, or otherwise, for an answer to a question like that, but I have the impression that, as time grew on, there was a reticence to show various documents. I had the impression that the records involving various fluctuation matters, for instance, should have been shown.

Q. But you cannot give any definite times or any persons who have refused you your right as a citizen to the files of the Federal Government in respect to the Radford project?

Mr. JACKSON. I object to the question, as I do not know that the witness is competent to define what his rights would be.

The COURT. I do not think the question is properly phrased. Ask how he was treated.

By Mr. THOMPSON:

Q. Well, how were you treated by the War Department (that is the Engineers Office), and how were you treated by the Federal Power Commission, with respect to the Radford project?

A. Well, I think in general very well, but on the specific point on which you are touching as to placing me in touch or exhibiting documents which I believe were pertinent to the matter, there were various occasions, both at the office of the Chief of Engineers and at the Power Commission, when there was a refusal to exhibit documents.

I have in mind one instance at both places. It began at the Federal Power Commission. At the time there were placed before me, and for more detailed perusal, by Mr. Fraser Horn, certain files, it was definitely understood that upon the occasion of my next trip to Washington I would have access to the files on the subject involving fluctuation. I do not know by what title that file was known.

The only reason for not going into it at that time, so far as either I was concerned or the then Chairman of the Commission, Mr. George Otis Smith was concerned, was that I did not have the time to do it, but, by the time I came to Washington next, the situation apparently had been changed.

There had been engaged special counsel for the Government in the matter, and the access to the file was refused.

As regards the office of the Chief of Engineers, there had, in general, been made available documents and reports, and I recall that within the past year I desired to see a report of a District or Division Engineer which dealt with New River in the case of a report upon the Bluestone project, and that report I was permitted to see. And, again, I did not have time to completely look over it, but, again coming, I was told that orders had been issued not to show that document.

Q. Well, you do not claim that you were refused the right to see documents which you, as a citizen, had a right to see, do you?

A. I would say that is a legal question.

Mr. JACKSON. We object to the question, as to what the witness' rights are.

The COURT. I sustain the objection.

Mr. THOMPSON. Exception.

By Mr. THOMPSON:

Q. You are an officer of the Franklin Real Estate Company, are you not?

A. I am not.

Q. You have been, have you not?

A. Never.

Q. Have you been a director?

A. Never.

XQ. You have spoken of being Consulting Engineer of the Defendant Company. Have you ever been the Supervising Engineer of the Company?

A. Not of the Company, no.

XQ. Or of any of the projects of the Company?

A. I have been Supervising Engineer temporarily with regard to the construction, and preparation for construction, on specific projects.

XQ. Have you ever constructed a power project?

A. Well I have acted as Chief Engineer of the companies actually constructing them.

XQ. But have you [interrupted].

By Mr. JACKSON. Had you finished your answer?

A. I don't know how one could get closer to the construction of a project than to act as Chief Engineer of a company in the design and the construction of the project. One cannot lay bricks and mix concrete and do all of that in building a large power project, although I have done each of those things in connection with smaller work in my earlier days.

Q. Have you ever constructed as Construction Engineer a power project?

A. Not from beginning o end.

Q. Have you ever operated a power project, speaking now as an Operating Engineer?

A. Not as a regularly engaged shift operating Engineer.

Q. When the London and Marmet power plants were constructed Mr. Slocum was the Defendant's Engineer, wasn't he, or the Engineer for the construction of those power plants?

A. He was Resident Engineer.

Q. Didn't he testify [interrupted].

A. May I finish?

By Mr. THOMPSON. Yes, I thought you had finished.

A. He was the Resident Engineer, with the title Construction Engineer in charge, but that title meant in all respects the local responsibilities of the work.

Q. And I believe you said there was a couple of months there when you actually went down on the project, or is that correct?

A. No, I didn't state I spent several months on the project.

Q. You were Supervising Engineer then?

A. That is true, that is, I actually performed the duties as pinch-hitter so to speak for the Chief Engineer of Kanawha Valley Power Company, who had met with an accident, and it was

a rather critical period in starting the construction of the London and Marmet developments. There were all the details to be cleared up with local land owners and getting contracts formulated and let, certain force account work and everything necessary toward getting the projects under way in order they might be completed within the rather exceptionally short time they were completed. I did the same kind of work which the Chief Engineer would otherwise have had to do.

Q. A Consulting Engineer may come in on a project after someone else has set up the plans and give his judgment; isn't that his function?

A. That may be his function in a specific case, but that is not by any means a statement of the field of the Consulting Engineer, nor of the field which I have occupied with regard to these projects.

Q. I just asked you the general question; you are giving us a grand talk each time I ask you a question. I asked the general question as to the functions of a Consulting Engineer in a general respect.

A. Will you read the question if I have not answered it properly?

Q. You have answered only away beyond the question. Now does a Consulting Engineer declare policies on a project?

A. In general he might declare them to his heart's content, for himself, but that does not mean the policies would be accepted by those who have responsibilities of ownership.

Q. Did you ever declare policies for the project on New River, taking for example first of all the London and Marmet dams?

By Mr. JACKSON. What is meant by declaring policies? I think that should be somewhat more explicit before it can be answered.

By Mr. THOMPSON. Policies of operation—policies of accomplishment.

A. I have time and again formulated what I believed to be appropriate policies for the owner of a project to adopt, and have recommended those policies, and in most cases I would suppose they had been accepted, but not in all cases have they been accepted.

Q. Have you ever been authorized by the Appalachian Electric Power Company or the Kanawha Valley Power Company to express its policies?

A. Undoubtedly, on occasions.

Q. And those occasions you became more than a Consulting Engineer, didn't you?

By Mr. JACKSON. I object to that question as argumentative, whether or not he did is a conclusion for the Court to draw, if material.

By the COURT. He may answer.

A. On various occasions and for specific purposes I was authorized to make statements of policy, statements which would bind the company.

Q. When you were before the West Virginia Public Service Commission you and Dr. Mead, you were speaking, were you not, for the company?

By Mr. JACKSON. I object to that. It appears he was a witness at that hearing.

By the COURT. He may answer. He asked if he did not appear for the company.

A. I cannot say I appeared before the Commission as representing the company. I appeared as an Engineer.

Q. You did state the policies of the company before that Commission, at the hearing had in 1930?

A. I may have. I don't recall.

Q. I hand you what has been identified previously as Government Exhibit #222 for identification, being a letter on your letterhead, addressed to Major H. M. Trippe, dated February 8, 1927, signed by you. I believe that is your signature.

A. That is my signature.

Q. I read to you the last paragraph of this letter: "So far as concerns water requirements from upstream—particularly from New River No. 6 or Radford development—the subject was discussed at the office of the Chief of Engineers while I was at Washington early last week in company with Mr. Bevan of Viele, Blackwell & Buck. We have had the privilege
2665 of seeing your report on the application for license. Study is now being made of a clause to be suggested for the purpose of covering the protection of navigation and at the same time allowing as far as practicable the operation of the proposed hydro plant on a peak-carrying basis—for that is the only basis on which that development is economically justifiable." That is your letter, is it not?

A. Yes, sir.

(Exhibit 254, being Letter dated Nov. 14, 1927, to Major E. D. Ardery on "New River Development #6 (Radford), Geological Examination," from F. W. Scheidenhelm was offered in evidence.)

(Exhibit 255, being Letter dated Nov. 17, 1927, to Major E. D. Ardery on "New River Development No. 6 (Radford), Geo-

logical Examination," from F. W. Scheidenhelm was offered in evidence.)

(Exhibit 256, being letter dated Oct. 16, 1931, to Major Fred W. Herman, pertaining to maintaining pool levels at dams 2, 3 and 4 on Kanawha River from F. W. Scheidenhelm was offered in evidence.)

(Exhibit 257, being Letter dated Sept. 18, 1934, to Major John F. Conklin on "Hydro electric Project of Appalachian Electric Power Company on New River near Radford, Virginia," from F. W. Scheidenhelm was offered in evidence.)

(Exhibit 258, being Letter dated Apr. 2, 1936, to Major John F. Conklin on "Radford Hydro Project of Appalachian Electric Power Company, Capacity Curve of Reservoir," from F. W. Scheidenhelm was offered in evidence.)

(Exhibit 259, being Letter dated Apr. 12, 1932, to Major Fred W. Herman, on "New River Power Wave Study," from F. W. Scheidenhelm was offered in evidence.)

(Exhibit 260, being Letter dated Apr. 20, 1932, to United States Engineer Department, signed by Daniel W. Mead and F. W. Scheidenhelm in type, under that "By R. H. Stearns" was offered in evidence.)

(Exhibit 261, being Telegram dated Dec. 10, 1930, to F. E. Bonner, Executive Secy., Federal Power Commission, from F. W. Scheidenhelm was offered in evidence.)

Q. When the Appalachian Electric Power Company filed its application, I think in 1926, originally, with the West Virginia Power Company—I mean in 1924, with the Public Service Commission, you had—I believe you testified yesterday the intention then of having just one dam, did you not?

A. I had nothing to do with any application filed in 1924, and I had no intention at any time in regard to a single dam, but it is my understanding that the predecessor of the Appalachian Electric Power Company, or more likely, the West Virginia Power Company, itself—because I believe it was in existence then, had such a plan.

Q. Isn't it a fact that the reason for the change in this from one dam to two dams was caused by the objection of the Electric Metallurgical Company, or the owner, the Union Carbide Company, on the ground that, if you had just one dam there, the waves would be destructive of navigation down below and would be destructive of the interests of the Electro Metallurgical Company at Glen Ferris Dam?

A. I think in reply that I should separate that into two parts: The reason for the change and the other reason for the opposition on the part of the Electro Metallurgical Company:

As regards the change, it is true that, so far as my recollection of the matter is concerned, it initiated—it was due largely
2666 to the fact that the Electro Metallurgical Company had riparian rights downstream, part of which it was utilizing and part it proposed to utilize, and this utilization of the water power was on the basis and presumably it would be continued on the basis of a relatively uniform use throughout twenty four hours of the day, seven days a week and so on, and that the use to be made of the power development by the West Virginia Power Company in the Bluestone region would ordinarily involve some form of peak carrying operations, with some form of variable flow, and those two things were not compatible.

If sufficient distance intervened between the development having a variable discharge and the power development showing, relatively, a uniform discharge, then question might arise. It did arise in the case of the Bluestone project, because there was a very short distance—only a few miles—from Hinton Dam site to Sandstone Falls not far below Hinton, and, moreover, that section of the river has a very steep slope, so there would be relatively less dampening out of any fluctuations.

As regards the other phase of the question that you ask, I have no doubt that the Electro Metallurgical Company expressed concern—some solicitude for navigation of the Kanawha River, but I suspect its primary cause was in regard to its own riparian rights and use of those.

Q. It did own the site at Sandstone Falls—Hawley first owned it and then it was sold to the Electro Metallurgical Company, wasn't it?

A. It is my impression that Sandstone Falls was by that time owned by the Electro Metallurgical Company or its affiliates and others were by the Electro Metallurgical Company, as there are now downstream from the Sandstone Falls, including Hawks' Nest and Kanawha Falls, existing developments.

Q. You were present at a hearing before Major Trippe on September 28th, 1926, at Radford, on the hearing of the
2667 application of the Appalachian Electric Power Company for a license to construct a water power project?

A. I stated that I was there as an observer.

Q. At that time, didn't the Electro Metallurgical Company make a protest?

A. In that connection—whether or not it was at that time or later on, I don't know, but it was in that connection.

Q. They announced that they would protest and later sent in a letter, didn't they?

A. I would not be surprised if that were true.

Q. That is in evidence as Government's Exhibit No. 101. Prior to that time, this company that you represent in no way ever indicated to anybody that they expected to change from a single dam to the two dams. Isn't that a fact?

By Mr. THOMPSON:

Q. Do you know?

A. The fact probably is that the idea of a two stage development did not originate with anybody until it originated in my mind, and in 1926, I don't believe I had studied the situation.

Q. So that your thought about the change came subsequently to 1926?

A. It did, within the limits of my recollection.

Q. Very briefly, you have testified that there is a site for a reservoir at Sandstone Falls. Is that a correct statement?

A. I would not call it a reservoir.

Q. A power site?

A. Yes, sir, there is a power site there.

Q. And the place is designated or has been designated from time to time as the gorge between Hinton and Kanawha Falls. There are, are there not, dam sites or power sites down through that gorge?

A. Well, it is a continuous succession of dam sites, but for economical development in that region, one is concerned
2668 more with the question of tunneling divers distances than with dam sites.

Q. You could construct dams there, though, to a height of forty feet and get a height sufficient to create power along there, could you?

A. Yes, it would be physically possible to construct them, but I don't believe they can be constructed to that height without a substantial change or cost for a change in the Chesapeake and Ohio Railroad tracks.

Q. Isn't its road-bed higher than 40 feet—something over 50 feet up from the bed of the river?

A. I don't know what the precise distances are. I am certain it is not 50 feet everywhere; that it is less than 50 feet in many portions, and I am doubtful if a 40 foot height could be constructed in a sufficient number of places to allow that figure to be used as a generalization with respect to the situation.

Q. The Electro Metallurgical Company, when it constructed the Hawks' Nest project had gates to more than 50 feet in height. Is that correct?

A. I think that is approximately correct, but one would naturally choose, and undoubtedly the Electro Metallurgical Company

chose, a place where that could be done, and it is simply my point that that is not universally true. I think that is the exception.

Q. They actually moved the railroad tracks there, didn't they?

A. Not within my knowledge.

By Mr. THOMPSON:

Q. Colonel, I call your attention to defendant's Exhibit 594, and in your testimony of yesterday at page 6237, at the top of the page, in which you say: "I consider a reasonable form of discharge is that depected on the chart forming Exhibit 594." I believe you testified, did you not, one of the reasons you stepped this wave up gradually?

A. No, I don't think I testified to that effect.

Q. Would you say that that was one of the reasons why it was a reasonable form of wave?

2669 A. No, I don't think so. It would have steps in it. Any reasonable form would have steps.

Q. It would be a much more reasonable form of wave than if the wave was perpendicular—the left-hand side, we will say?

A. Yes, that is true.

Q. It is a fact a wave that is perpendicular seldom exists, is it not?

A. I take it by "wave," the discharge from the power station which would result from an instantaneous opening up of the complete power situation. That is very rare.

Q. On page 6240, you stated as follows:

"Q. Have you given any consideration to the rectangular or block form of discharge from the power station? Mr. Thomas testified that he considered that in connection with his study of the power tides from the Radford station?

"A. I have. I gave consideration to that form, prior to the work of Professor Thomas and was responsible for his studies and tests with that possible form of operation, but I looked at it as embodying the literal meaning of possibility without any possibility of being probable, let alone certainty; I considered it to be a theoretical form—a theoretical plaything rather than anything in my opinion that would be reasonable to conceive as a natural occurrence."

That is your testimony yesterday, is it not?

A. Well, I think it is except for a few garbled words.

Q. Now, turn to Government Exhibit 227. That wave No. 1, isn't that practically perpendicular?

A. It is very close to it.

Q. Do you think that is a fair test of the type of wave to be used in testing as to waves going down this river?

2670 A. A fair test in what respect?

Q. A fair test of the fact that you say such a wave as the rectangular wave (that is with a perpendicular side to it) is only in the realm of the theoretical and not practical?

A. No. I said, I believe, and still say, that any instantaneous, or almost instantaneous, bringing on of the complete capacity of a power station containing a number of units, is not beyond a possibility, that would occur in cases of emergency. Also the cutting off of the discharge of a power station practically instantaneously, by reason of the interruption in connection with the transmission circuit, but I do not conceive that it is a reasonable expectation with regard to a station like the Radford station, that it would open up the complete capacity instantaneously and continue operating at that capacity for eight hours, and then cut off instantaneously.

Q. Yes, but were not you giving a test here in 1930 by which you were going to judge the Radford project and its discharge and the effect of that discharge upon the river?

A. I do not believe it is proper to say "by which I was going to judge the Radford project or its discharge," but the aim was to propogate various forms of power tides or waves, so that from them there might be gained as much light as possible with regard to the future prospective performance of power tides or various forms which might be propogated by the Radford station.

Q. You were in charge of this demonstration which they used up at the Buck and Byllesby, were you not?

A. Yes.

Q. You were practically the man at the throttle, weren't you? If they don't use a throttle, what do they use when they open up for waves?

2671 A. It is hardly a throttle, but the metaphor may do.

Q. You were the man who was there and conducting how the waves or discharges were going, were you not?

A. The waves were released under my direction.

Q. And when you released those waves, wave No. 1——

A. (Interposing.) I didn't release them.

Q. You had somebody else release them?

A. Yes.

Q. And under your charge and direction?

A. Yes.

Q. Wave No. 1 is practically perpendicular, isn't it?

A. Well, at the Ivanhoe Gaging Station it was practically so, and undoubtedly it was at least as much of that form at Buck.

Q. And wave No. 2 was the same way, wasn't it?

A. Yes.

Q. And wave No. 3 was the same way?
A. Yes.
Q. And wave No. 4 the same way?
A. Very closely.
Q. Wave No. 5 also the same way?
A. Not so much.
Q. It is almost imperceptible, the change, isn't it?
A. It depends on who was looking.
Q. You are a good looker; what do you say about it?
A. I say it is not.
Q. Wave No. 6, isn't it?
A. Very closely.
Q. And the left side of wave No. 7 is, isn't it?
A. Yes.

Q. So that these waves had at least one side, the side of a
2672 rectangle, as they came from the discharge; is that right?

A. They had practically a vertical front as they left the Buck site, and as they passed the Ivanhoe Gaging Station site.

Q. In view of what you testified to yesterday, was that a fair basis on which to make a test for that type of wave?

A. If anything, my impression is that it would, with the amount of water available, result in lower amplitude downstream if one were to depart from that.

Q. Read my question.

NOTE.—The question was read.

A. Well, I think it would probably have been somewhat more illuminating if, at that time, one had known precisely what kind of operation there would be at the Radford power station and released a wave which, in its performance in passing the Radford site, would have had precisely that future form and met precisely the stream bed conditions as regards base flow, and otherwise, which would be met under future operations. Under those circumstances, one would have had the equivalent of the action of real Radford power tides, released from the power station, but there was no such opportunity. One could not know then any more than now what the process is.

Q. But I am asking now, in view of all your foresight and hindright in these matters, are these forms of waves a fair test, when you are going to relate it to the conditions at the Radford project?

A. I do not think there is a one of the lot that represents a specific form such as would ever be released from the Radford power station, or even is that true in passing the Radford dam site, but it is more nearly true of their forms in passing the Radford dam site.

Q. Being an expert in this wave matter, and having given us this design in this defendant's Exhibit No. 594, why couldn't you have stepped those waves up a little, as was done in 594?

2673 A. Leaving aside the matter of being an expert in wave matters——

By Mr. THOMPSON:

Q. (Interposing.) I thought you were.

A. (Continuing.) I will say it would have been possible to have stepped those waves somewhat, and to have used somewhat different forms than were used.

Q. Then why didn't you do it?

A. I don't recall the reason. I think, for one reason, that we didn't know as much about it as we do know, and we do not know everything about it now. We know a lot more about it than we did then.

Q. What was the volume of wave No. 1 as it came out from the discharge, and as shown on the map, above Ivanhoe?

A. I do not know off-hand, but I can give you an estimate made by an assistant.

Q. You testified yesterday that the discharge reached a maximum of a little short of 14,000 second-feet, and somewhat in excess of 15,000 second-feet at the Buck; where was the discharge of these waves that you were showing us of 14,000 and 15,000 second-feet?

A. My reference, as I recall it, to a discharge a little less than 14,000 was an estimate at Ivanhoe Gaging Station, and the reference about 15,000 was a pure judgment estimate on my part to the effect that if a given wave had an amplitude in second-feet of a little under 14,000 second-feet at Ivanhoe, it would have an amplitude definitely greater as it left the Buck site.

Q. That was a guess then, was it not?

A. Purely so, and I think I stated that in effect.

Q. How long did this discharge of 15,000 or 14,000 second-feet last?

A. As I stated, it was very brief. It was peak discharge—I mean peaked in form.

2674 Q. So you would not have the Court to believe that at any time these waves were made on 15,000 or 14,000 second-feet discharge, would you?

A. I thought I was rather careful to state with regard to the waves of maximum amplitude, namely, waves 15 and 16, that I did not consider that they were typical of anything.

Q. And you have no wave here made from a continuous discharge of 14,000 second-feet or 15,000 second-feet?

A. If by that you mean over any prolonged period, such as 6 or 7 hours, or even a few hours, the answer is no.

Q. As a matter of fact, you could not discharge over that time there, an hour or an hour and a half, at the rate of 15,000 second-feet, could you? It is less than that, isn't it?

A. No, you could not. That was the limitation of the amount of water available there. That is the head began to drop, and, therefore, the discharge automatically decreased.

Q. Was one of the reasons why you did not make the waves of greater duration, or of greater volume, because there was not sufficient water in the reservoir?

A. Yes. That is the sole reason that we did not get greater prolongation of them. As a matter of fact, after this series of tests was completed, we endeavored to find a time when conditions on the river would be better adapted for getting waves of still greater volume, greater amplitude and longer duration at the time of propogation. I think I was after a period when the in-flow into Byllesby was something like 3,000 second-feet, hoping to get about that condition, but the condition did not occur within a number of months, perhaps a year, after these tests were completed, and then other matters interfered, and I was unable to bring about the making of these further points.

2675 Q. So your trouble there was you did not have capacity in your reservoir to have waves of any other length, or capacity, or duration, or volume?

A. That was the obstacle to having waves of greater amplitude and correspondingly greater duration. We had pretty fair volume in some of these waves, however. There were certain waves which had volumes which were in general order, although not equal to that of the discharge, as per Exhibit 594. There was one wave, and perhaps more than one, that had a volume approximately equal to the daytime load, as indicated on Exhibit 594.

By Mr. THOMPSON:

Q. Which wave was that?

A. In the case of No. 11, the volume of that wave itself was about 2900 second feet days, which is a little greater than the principal element of discharge for Exhibit 594. In the case of wave 10, it was a little lower.

Q. A little lower?

A. Yes.

Q. And wave 10 is practically perpendicular, isn't it?

A. Wave 10 was almost so at the point of initiation.

Q. Now, isn't it a fact that there are two causes of flattening by waves, and both of them are gravity? In other words, if you have a fountain piling water up in the air, it comes down,

and that is pulling down of the earth; and isn't the second factor that there is a flattening out because of the downstream pull on the water?

A. I certainly can agree as to the law of gravity effect, but as to the other I confess I do not understand.

Q. I ask you if this kind of wave you named such as
2676 1, 2, 3, and 4, with the perpendicular line indicating that the discharge was immediately at its extreme, wouldn't those waves naturally, with a short trough between them, wouldn't the tendency there be for those, to use a layman's word, to melt down going downstream? In other words, to level off?

A. Are you referring to 1 to 3?

Q. Yes.

A. I do not think that is true with respect to those more than others.

Q. Wouldn't that be true with respect to those as with respect to defendant's Exhibit 594, where you have such a large base?

A. Given a sufficient distance for travel, I doubt whether the precise form of propogation has a great deal to do with it. If one looks at that same exhibit 227, the forms of the waves, after they have once accommodated themselves to the stream bed and the steepness of slope of New River, do not differ greatly. I have been, myself, unable to determine, from looking at the form of a wave as it passed Hinton, or even the Radford site, to tell what kind of form it had at the point of propogation. They have, roughly, the same general forms after they get started down the river.

Q. Now, turn to Government Exhibit 226; on page 5848, Professor Thomas said:

"Q. Would you say the mode of operation of #226, as indicated by that chart, was as reasonable as the mode of operation on defendant's Exhibit 594?

"A. I can't say one is more reasonable than the other. In my opinion they are both of the same general type."

Now, looking at Exhibit 226, I note there that there is an allowance made for Saturday and Sunday; in other words,
2677 the discharge dropped very decidedly on Saturday and Sunday.

A. What do you mean by "allowance made?"

Q. I corrected it by saying a discharge. Now, why didn't you, in making these tests, make some such allowance as that at the Duck and Byllesby dams in 1930?

Mr. JACKSON. An allowance of what—of shutting down?

Mr. THOMPSON. A stopping off of the peaking during Saturday and Sunday?

A. Well, there are several reasons, I suppose. I don't know whether it would have been done if physical conditions had permitted it, but actually the limitations of pondage at Byllesby made it imperative to let go, so to speak, once the pond filled up and the water over topped the gates.

Q. Then you would not have a wave on any test here in 1930 comparable to the situation such as you would have had at Radford on Saturday and Sunday, would you?

A. No. That element was recognized and covered by the studies and experiments of Professor Thomas.

Q. Now, isn't it a fact that the trough of the wave between Friday and Monday is much longer than the trough between the waves of Monday, Tuesday, and Wednesday?

A. It is longer than the troughs between waves propogated successively on Monday, Tuesday, and Wednesday.

Q. And isn't the problem down below, after all, a wave which has a very long trough or a very long crest, rather, as compared with little short waves, as you have shown here on Exhibit No. 227?

A. I am not certain that it is, no.

Q. You would not say that it was not, would you?

A. I would not say that the results obtained by Professor Thomas did not take those factors into account.

Q. I am asking you about yourself—your views, and not his views.

2678 A. Repeat the question.

A. I should continue by stating that the reason for my statement is that I am not at all certain that that is the problem, and I assume you mean the major problem, the difficult problem. My reason for the view that it is not such as the result Professor Thomas obtained. He specifically considered that aspect. That is not covered in this series of 1930. That is, there was no gap between propogation of waves such as would correspond to a week-end shut-down of Sunday or Saturday night. There is nothing so long as 24 hours. It was impossible for the reservoir would not hold the water.

Q. What I am saying is, that that 1930 test was not a fair representation of the type of wave which you will discharge out of your Radford project if you operate it in a form such as is shown on Exhibit 226, or as your wave on 594?

A. When you use the word "fair" or "unfair" in connection with the 1930 series of tests, it carries an implication that any given form of wave propogated at Buck and Byllesby was intended to represent a given form of operation at Radford. Now, such is not the case. It was rather intended to cover a variety

of forms of power tides under the best conditions that were available then. I have no doubt that the tests could have been conducted with greater intelligence if the available facilities could have been used, but with our limitation of mind and the physical conditions, we did the best we could. The object was to develop information on the basis of which further studies could be made, and Professor Thomas took it up from that point and made studies which, among other things, involved the integrating model——

WITNESS. I have not attempted to say what Professor Thomas said. He, of course, can and ought to speak for himself, but you were asking my view, as I understand it, as to what conclusion I would draw, and I must say that my own conclusions, as
2679 of the present time, are affected not merely by the results of the 1930 wave tests but by the studies and tests which were made by Professor Thomas under my general direction.

Mr. THOMPSON:

Q. So that, if I gather correctly from you, these waves were discharged down there with what knowledge was had at that time, but now would be regarded as almost going in the dark, so far as the waves are concerned?

A. I don't think you understood correctly what I said, no.

Q. Well you have not given waves here that are in any way comparable to the system of waves you would be discharging at the Radford project, have you?

A. I would say they can be compared, that some deductions can be made from them, that they cannot be used within precise limits but certainly the behavior of power tides traveling over a distance of two or three hundred miles on New and Kanawha Rivers is indicated in various respects and to a good purpose for drawing further conclusions, particularly when one works with models, which with a sufficient degree of accuracy can duplicate these results of 1930, then it may be reasonably assumed those same models will reasonably duplicate results from other forms of power tides generated at the same point, traveling by the same gaging stations.

Q. You did not work with any models?

A. Personally I did not.

Q. So that is hearsay from what Professor Thomas said?

A. Not completely. When he said he had certain results I accepted his statements that such and such results followed.

Q. That is hearsay, isn't it?

A. As far as results of computations and experiments and so on are concerned it is hearsay of the same kind I have in

2680 my office if an assistant says to me "I did so and so with such results."

Q. Were you present when Professor made any tests?

A. I saw the models work.

Q. You saw the tests made?

A. Not all of them.

Q. How many did you see?

A. Very few.

Q. When did you seem them made?

A. During the course of this suit.

Q. Did you see the test of a wave like wave #4 for example?

A. No.

Q. What waves on here did you see run through his model?

A. None.

Q. Now let us go to wave #4 on Government Exhibit #227, and let me ask you if the gradient from Ivanhoe to Radford isn't very much steeper than from Radford down to Hinton?

A. Well except for the section between the Norfolk & Western crossing at Pepper Tunnel and the flat section of the river around the Horse Shoe Bend I don't think it is substantially different.

Q. When you considered the question of these waves going down the river, for instance wave #4, did you take into consideration the fact that Radford is approximately fifty miles nearer than the place from which the wave was discharged, that is fifty miles nearer to Kanawha Falls or lock #2?

A. Yes, that is an obvious fact.

Q. Wouldn't a wave that started from Radford, a 9,000 second-foot wave, beginning say on Monday morning, and lasting for eleven hours, discharging for eleven hours, wouldn't that be much more liable to keep its form than a wave that would start from Ivanhoe?

A. What kind of wave from Ivanhoe?

2681 Q. The same, say 9,000 second-feet—I am considering a wave of the same volume, wave of 9,000 second-feet?

A. And the same form?

Q. Yes.

A. Except for that relatively short flat section around the Horse Shoe Bend I wouldn't think there would be a great deal of difference. Possibly out of the Buck station or Ivanhoe, as you refer to it, there might be a little more assumption of what I think is the general form set forth on Exhibit #227. Of course if you mean that is measured at a given point downstream I would say that it follows as a matter of course that a wave of given volume and form, released at Radford, would persist

somewhat further downstream, would adhere more nearly to its original form as measured at some downstream station than a wave of the same volume and same form released at Ivanhoe, providing all other conditions are the same, including water in the stream bed, that is the relative emptiness of the stream bed.

Q. Now this wave #4, was there any interference with it, with respect to the raising and lowering of wickets?

A. As far as measured in the Kanawha River I believe there was not. I shall check that. There was a wicket operation I believe just before the preceding wave came to its succeeding trough, and that was in the case of lock #6, I believe, but it is very questionable whether that influenced the form of volume or amplitude of wave #4 at lock #6. It might have, but I think it is questionable. I should say the probability is it did not.

Q. Following wave #4 down the river, what do you find its volume to be at Radford?

A. At the Radford dam site about 1,620 second-foot days.

Q. What is that in acre feet?

2682 A. About 3,200 acre-feet.

Q. And what is it in acre feet when it gets down to lock #2?

A. About 2,800 acre-feet.

Q. So it retains 60% of its volume, does it not, when it gets down there?

A. Well I don't believe it actually did. Various information indicates quite definitely that is not true.

Q. Didn't Professor Thomas agree it was approximately 2800 acre feet?

A. He was giving the same sort of information which I have indicated here when I said—what was it—1,620, perhaps I should not have stated that that was the amount. I have even during the pendency of this suit checked up on that Allisonia gaging station, which is in operation, and the rating curve, which is subject to check from time to time, and have been informed by the office of the District Engineer of the Water Resources Branch of the Geological Survey for Virginia that the rating for Allisonia is somewhat in error, and that carries an implication very strongly to me that the difference between the Allisonia and the dam site "A" rating curve, which was only a temporary one, and based on very few measurements, is in error. The whole thing looks fishy to me, so to speak, with regard to that wave #4 and others at the dam site. For instance, if I read down the column of computations made in my office for Wave #4 I have these figures for volume:

At Ivanhoe 2160 second foot days.
At Allisonia 2060 second foot days.
At Dam Site "A" 1620 second foot days.
At Eggleston 1770 second foot days.
At Glen Lyn 1740 second foot days.
2683 At Hinton 1,720 second-foot days.
At Caperton 1,200 second-foot days.
At Kanawha Falls 1460 second-foot days.

Now those variations say to me one cannot rely on them. I wish we had more accurate data. I wish we knew more about it than we do, but the indication is very strong and outstanding to me that the dam site "A" rating, the one ordinarily referred to here as the Radford rating, is wrong, and the Allisonia is somewhat wrong, which makes the dam site "A" rating appear all the more in error.

Q. Well if as you say this thing looks kind of fishy to you, what is the worth of all these waves then; aren't they useless; aren't they based on a lot of useless data?

A. No, one element of all these tests that is very clear cut and is not in error except as regards possible slips now and then by gage readers, as for instance at the navigation locks and at Pack's Ferry gage is the amplitudes in feet. Stages in feet are of a pretty close order of reliability.

Q. Take #4, how about it in feet, when did you discover these errors you speak of?

A. We have had doubts about them for a considerable period of time, but various things brought out in the suit, in connection with the examination of various witnesses, caused us to make some inquiries and see whether any additional information had been worked up.

Q. Didn't Professor Thomas testify at Radford it was 1620 second foot days?

A. He gave the same figure I have here, and that is what appears on the face of the chart. That he did not use at his control gaging stations in his integrating model. He was concerned with amplitude in stage at those points.

Q. Isn't the real question the amplitude in volume rather
2684 than stage, when it comes to navigation?

A. I don't think it makes a hoot in Hades what the volume is as long as it is spread out over a period of twenty-four hours. One can stand on the river and wear one's eyes out waiting for the river to rise. It is the amplitude that counts.

Q. Might you not, with your trained eye, not be able to see the river rise, and still a volume down there to cause a disturbance in one of these pools?

A. I would not attribute any importance to my own eyes, they are just normal, and that is true of any one else. Take wave #4 on its amplitude scale on Exhibit #228. It took it something like eight hours to rise something less than three inches, or at most three inches.

Q. It was six tenths of a foot high at lock #2, wasn't it?

A. I was referring to lock #6, if I did not state so.

Q. How about lock #2?

A. At lock #2 it took between five and six hours to rise a total of $^{45}/_{100}$ of a foot, a little over five inches.

Q. You could observe it, could you not, it was observable on the records every day, lock #2, one-half foot high, wasn't it?

A. Yes, by plotting any one of these and bringing the horizontal scale together one may make it show up, but to recognize on the river a rise of something under one inch an hour is not possible for the human eye.

Q. At lock #4 it was $^{7}/_{10}$ of a foot high, wasn't it?

A. That is true.

Q. And at lock #5 it was $^{6}/_{10}$ of a foot high, was it not?

A. I think that was $^{5}/_{10}$.

Q. Well call it $^{5}/_{10}$.

2685 A. I think it is $^{5}/_{10}$. On Government Exhibit #228 the trough is labeled at elevation 10.60 gage reading and at the crest 11.10, and the difference between the two is $^{50}/_{100}$ of a foot.

Q. Are you measuring from the line—from trough to trough up to the crest?

A. I thought we were talking about the variation one would observe standing along the river, and that would just be a comparison with a preceding trough.

Q. Wouldn't the fall be one whole foot, and that being true, instead of $^{6}/_{10}$, look at your wave going down the river #5 [interrupted].

A. You are referring to the trough from the crest of this wave #4 to its succeeding trough?

Q. That is right.

A. That is true so far as standing along side it and observing it is concerned, but that trough was not all due to the wave. That water is superimposed on a falling tide of the river. Now it follows also that the rise at lock #5 would have been somewhat greater than five inches, if one spoke technically as to the amplitude of the wave; and that it would measure to be somewhat greater than might make it 5½ inches.

Q. We are pretty nearly in accord then. Now on #6?

A. #6 wave or #6 lock?

A. #6 lock #4 wave?

A. Well the change there is a scant 3/10 of a foot, as plotted from the preceding trough to the crest, and it wouldn't make any great difference even if measured from an inclined line which would probably make it a full 3/10 instead of a scant 3/10 of a foot.

Q. Lock #9, what do you make it there?

A. Well there the conditions were such that the Hunt-
2686 ington District Office and I agreed the wave was undistinguishable.

Q. It is a fact, isn't it, that wave #4 so far as you state is observable or recorded as far down as lock #6?

A. Yes.

Q. And even these poor waves such as this one, which was apparently shot up perpendicularly, does carry that far down the river?

A. So long as you don't ask me to agree they are poor waves, if you said they were inconsequential [interrupted].

Q. So far as making any comparison with the kind of wave you have been showing us would be propogated at Radford they are practically useless?

A. They were neither inconsequential nor useless.

Q. Let's go to wave #10 a moment. I think you said this morning that there were actions by the rising and falling, or lifting and falling, of the wickets at #6 dam and #7, fourteen wickets, I think raised at #6?

A. Yes.

Q. So there wasn't any interference until you got down to #6 on this wave #10, was there?

A. I believe that is true.

Q. How many wickets are there at lock #6, if you know?

A. I don't know off hand.

Q. Isn't it about 139 or 140?

A. I don't know the number of wickets that were shifted, but such as definitely affected the water level in the river, otherwise those wickets would not have been shifted. That is a routine operation of that particular dam.

Q. In response to a question of counsel I think it was this morning, you gave the average reduction in amplitude of
2687 all the waves, I think there were seventeen, I am not certain about that——

A. Eighteen I believe.

Q. You gave that as five inches, did you not, or five and one-half, or something of that kind?

A. I intended to state and believe I did state that the amplitude in inches as shown by the eighteen waves on the average at lock #2 on the Kanawha River was approximately five inches.

Q. That being so, and assuming now the operation, construction and operation, of the London dam, without a draw-down, would it not seriously affect, such a wave, seriously affect navigable conditions in the London pool?

A. I believe it would not.

Q. The word has been used here by your counsel several times as to whether the pool was kept or these pools were kept at a "mathematically accurate elevation." Do you understand whether they are or not?

A. I understand they are not.

Q. What variation is permitted by the Government in the Marmet pool, if you know?

A. 3/10 of a foot, that is below. Then actual variations take place above. That is merely a temporary working basis.

Q. How much above, what variation above?

A. There is no fixed limit.

Q. What is the ordinary variation above the ordinary pool level, if you know, of the Marmet pool, due to ponding from the London pool?

Q. Don't you know the Lock Masters down on both the London and Marmet, particularly the Marmet, are under command that the moment that pool level drops 1/10 of a foot they are ordered immediately to rectify it?

A. Presumably by opening a gate at London.

2688 Q. Any way [interrupted].

A. I do not—I don't believe it is true.

Q. And if it goes 1/10 of a foot above normal pool level they have the same order?

A. Well they have an order to keep the pool at approximately the normal level on the upper side. I think they would endeavor to keep it within a range closer than 3/10 and I believe that ordinarily they do. There have been various times when the amount over the gates was greater, I don't recall any recently greater than about 15/100 or 2/10 but as to variations lower than normal pool level in the amount of 3/10 of a foot I do not believe it is a fact there are instructions to the Lock Masters at London to release water from the London plant as soon as the Marmet pool is as much as 1/10 or 2/10 of a foot, or even 3/10 of a foot, below the normal pool level, nor is there any instruction to the power company that it shall release water under those conditions from London.

Q. What is the normal pool level of the Marmet pool?

A. In terms of elevation above sea level it is 590 feet.

Q. Is that an even figure?

A. Yes, sir. I might say that regardless of what the instructions are to the various Lock Masters and gate operators, that it

is just not physically possible to keep the pools at an absolute level.

Q. But are they not ordered to keep it as close as possible, even to a mathematical point, if they can?

A. Not for that London pool and its three-tenths.

Q. How about Marmet?

A. I should have said Marmet pool and its three-tenths, and, of course, at London the variation is three feet, plus whatever the variation on the upper side above the pool level may be.

2689 Q. I think you said, Colonel, that you were instrumental in negotiating the contract for the establishment of the power plant and the regulation of stream flow and all that went with it at the Marmet dam. Am I correct about that?

A. I participated in that negotiation in my engineering capacity.

Q. Wasn't allowance made there of 250 second-feet for lockage upon which you computed your figures for the rental?

A. There is, of course, no contractual arrangement in that respect at all. The fact is that when the economics of the problem were figured at the various offices of the War Department, particularly at the District Office, there was an allowance for leakage and lockage made in the total of 200 or 250 second-feet. I do not recall which, an allowance in the sense that their estimates of total flow, volume of flow, or rate of flow at any given time, were reduced by 200 or 250 second-feet, so as to reach a figure which they felt surely would represent availability for power purposes.

By Mr. THOMPSON:

Q. I wish that you would turn to Government Exhibit 156. For the record, I should say that this is the hearing before the State Corporation Commission of Virginia held July 28, 1932, Ex Rel Appalachian Electric Power Company, Application for License to Construct a Hydro-Electric Development on New River near Radford, Virginia. Turn to page 56 and I want to read to you from a paragraph there. The heading of the page is "Scheidenhelm."

"A. We propose to install four vertical shaped hydro-electric turbines. Each is to have a rated capacity of about 26,000 horsepower at approximately 110 feet net head with a combined capacity for the same rating of approximately 104,000 horsepower. When operated at that head of 110 feet, and at the point of maximum efficiency, these turbine are intended to utilize

2690 about 9,000 second-feet of water, which is about 2.7 times the average flow. When the turbine gates are fully opened and 110 feet of net head is available, the consumption of water

would actually be about 10,000 second-feet or, roughly, three times the average flow of 3,300 second-feet. That is one reason—that is the reason—why it seems unnecessary to provide for any enlargement in the future. The relation of the proposed installation to the stream flow is beyond that which is ordinarily installed in a development of this kind. It is made possible by reason of the large power market of the Appalachian Electric Power Company." Did you make that statement before the Commission?

A. I think I made it in that general form, although there are some stenographic errors in it.

Q. Looking at the bottom of page 57: "Q. I would like to ask you for your expert opinion with respect to the adequacy and suitability of these proposed structures, for the efficient utilization of the water power which is available here, with a brief explanation in support of your opinion. A. That question might well be answered in two parts. The first part, referring to the capacity of the power plant, has in reality already been answered; that is, the hydroelectric units will be of sufficient capacity to utilize water in an amount three times as great as the average stream flow and that is a ratio which is well beyond ordinary possibilities. That is due to the fact that this large power system can absorb a development from this power station. The second phase of the answer to the question has to do with the character and efficiency of the equipment. As to that, I may say that the intention is to have turbines of highest efficiency and that efficiency will be well above 90 percent, and likewise the generators, which efficiency will be well up to 96 or 97 percent, so that once the water reaches the turbines it will be used to the very greatest efficiency." Did you make that statement?

2691 A. I think I made it in essentially that form.

Q. On page 81: "Q. Will you state what recreational, scenic and commercial benefits may be expected to flow from the construction of the project reservoir? A. The reservoir will be, in effect, a lake, a fresh water lake, which by reason of its geographical location, will make it unique. Also its size will make it unique. It will be the largest lake in Virginia. It will be close to an important highway, the Lee Highway. It will have no near competitor, no practical competitor at all by way of a lake for recreational purposes in that part of the country. The nearest large bodies of water, I believe, are all artificial and are a substantial distance. West Virginia has no body of water so large. In North Carolina there may be some on the other side of the mountains. Lakes of this kind are found to be used very generally for recreational purposes, particularly in the summer

time for swimming and boating and fishing." Did you make that statement?

A. I believe I did.

Q. Then you make a reference to the Lake Lynn Development on Cheat River. How long is it since you have seen Lake Lynn?

A. Several years.

Q. There is a very active boating on there now, is there not, by motor boats and other boats of that kind?

A. I have no knowledge of that.

Q. Turning to page 92: "What is your opinion of the question as to whether or not this project will involve unreasonable interference with stream flow? A. Any dam that is put across a stream and has gates in it involves some potentiality. However, the applicant realizes that there must be no unreasonable interference with the stream flow and has made the investigation up to this point, and expects to make further investigation if
2692 permitted, with the positive realization that there must be no unreasonable interference with the stream flow but in that connection I would like to point out that this project is unique, very unique, in that there is a source of water supply immediately downstream from the dam which in itself is partly marketable." Did you make that statement?

A. Certainly not in that form.

Q. What form did you make it in?

A. I don't know.

Q. Is there anything wrong with the statement or did I read it incorrectly?

A. No, but the Court Reporter must have taken it down incorrectly—not the Court Reporter, the Commission Reporter.

Q. Wherein is it incorrect?

A. Well, the last thing that caught my attention was "marketable." That certainly doesn't belong there.

Q. Is that the only correction you would make?

A. Well, I don't know. I would want to study that.

Q. What word do you think you used?

A. I don't know.

Q. Would you say that substantially what I have read you said?

A. I am inclined to think that the general import is correctly conveyed.

Q. Did you have corrections made of the record after the hearing?

A. This doesn't look like it, and I don't recall any.

Q. Did you get a copy of it?

A. Well, I probably did but these commission records come along a long time afterwards and certainly I could not

2693 have seen this and made any corrections in the record. I could not have seen the original transcript of this.

Q. Would you suggest where you would correct it, what words you would correct?

A. Well, I don't suppose I ought to be put in the position of giving my testimony over again. I have stated that the general import, I believe, is correct.

Q. (Reading on:) "May I call the Commission's attention in that respect to Exhibit B. Just downstream from the dam site as shown on Exhibit "B", distant a half mile, is an influent tributary of New River named Little River. It empties into New River within the limits where riparian ownership is in the applicant or its affiliated corporations. That stream has a drainage area of a little over 300 square miles. At the gaging station at Grayson (I understand that is Graysonton) the drainage area is, I believe, 302 square miles. It's low water fall is remarkable (I rather imagine the word 'fall' should be 'flow'). It has been gaged and measured and is being measured by the Water Resources Branch, or bureau, of the State Commission on Conservation and Development, and, according to the records of that Commission, in the low water season of 1930, which was practically the same in its effect on the water supply as the low water season of 1925, the minimum flow of Little River was 77 cubic feet per second. That flow persisted for only a day or two. In fact, for the five days centering upon the minimum flow the average stream flow was reported by the Commission's Engineers as being 95 cubic feet per second, 118, 77, 82 and 80 second-feet respectively. The following day the flow went up to 159 second-feet." Did you make that statement?

2694 A. Well, it sounds as though I made it. I don't know about the figures, whether they were taken down correctly.

Q. I want to call your attention to a hearing before the Public Service Commission of West Virginia, page 1548, West Virginia Power Company application for permit to construct dams on New River for hydro-electric purposes, and I am reading from Government Exhibit 253 for identification, from page 107: "Q. What have you to say as to the advantages or the disadvantages of the amended application of two dams over the original plan with one dam? A. The following considerations appear to me to be outstanding and they are all advantages in favor of the change from one-dam scheme to a two-dam scheme of development: First, the Bluestone project in its original form would have been economically feasible only after reliable examination, that is, after reliable examination for carrying big peak loads. Of necessity, this would have resulted in greatly fluctuating stream flow in New River

down-stream from the power site, and, in particular, from the power site and the junction of New River wtih Gauley River, or, in other words, the head of navigation on the Kanawha River." Did you make that statement?

By Mr. JACKSON. I object to the question. The witness was cross-examined about this this forenoon and this isn't contradictory of anything he has stated.

By Mr. THOMPSON. I didn't cross-examine him on that at all.

By Mr. JACKSON. You cross-examined him about the plans.

By the COURT. I will let him answer that question.

By Mr. JACKSON. Let our exception be noted.

A. I undoubtedly testified on that subject matter but it certainly is a garbled record.

By Mr. THOMPSON:

Q. You don't think that stated your views then, do you?

A. Well, I think there is some import that would come from it in spite of all the garbling.

Q. You have got a copy of it there, haven't you?

A. Yes.

Q. Where did you get that copy?

2695 A. We got that from my office and it got to my office from the Public Service Commission of West Virginia.

Q. Did you ever ask them to make any changes in that record?

A. Not within my knowledge.

Q. You read it after you got it, didn't you?

A. Not within my knowledge.

Q. You just made this statement and then went away and never afterwards looked at any record of what you had said before that Commission?

A. I don't know whether I did or not.

Q. I am reading from page 108. [Reading:]

"Secondly, it is believed by me, from the standpoints both of down-stream riparian owners and water power developments, and also of the best interests of navigation on the Kanawha River, the applicant power company would not be justified in taking the risks of constructing or attempting to construct the original single stage Bluestone project, with its 140 ft. dam at the Hinton site, in as much as that dam and power station, and in particular the operation of the power station, would be dependent upon the legal right and the practical ability to operate that power station primarily for carrying peak loads. The carrying of the peak loads means fluctuating output from the power station."

Q. (Continuing) Did you make that statement?

A. I believe I did.

Q. What do you mean by the words "legal right"—"dependent upon the legal right?"

A. That is six years ago. I would have to guess what I meant by it then.

2696 By Mr. THOMPSON:

Q. You said it was dependent on the legal rights. You mean they had doubt about it?

A. Probably the principal things were that there might be rights of the downstream riparian owners.

Q. But that description of the power station carrying peak loads, that is your view, is it?

A. It being the intent that carrying peak loads and fluctuating output are synonymous. It does not necessarily mean the top of the variable load.

Q. You used the phrase big peak loads. What is that?

A. That proposed power station, whether it be a single stage or at Bull Falls—a big hydroelectric station with a capacity as compared with the Radford plant here from 70% to 100% greater.

Q. You didn't intend to have a peak load at the Hinton reservoir, did you?

A. If you mean the Hinton development of the Bluestone power project divided into two parts, no; if you refer to Hinton dam as being erected at the Bluestone site, and I note I used the words "with its 140 foot dam at the Hinton site," the answer would be "Yes."

Q. You mean a big peak load at the Hinton site?

A. Yes, sir.

Q. On page 109, I read as follows [reading]: "Thirdly, under the present scheme of development, which is the scheme proposed in the amendment of application, such peak load operation, with extreme variation in water output from the power station, can be carried on to the maximum practical degree at the ups'rear or Bull Falls development without any resistent interference
2697 with the rights of riparian owners or with navigation or the navigable capacity of the Kanawha River. The operation of the Hinton development will be subject to the necessity of re-regulating the discharge of water from the Bull Falls development, and it has the function of operating and will be operated so as not to interfere substantially with navigation on the Kanawha River or with the rights of downstream riparian owners."

Q. (Continuing.) Did you make that statement?

A. I did, I believe, in essentially that form. There are errors in it.

Q. Is it your understanding that a reservoir of the type of Bull Falls, if you did not have a re-regulating reservoir, that it would endanger navigation below?

A. I do not think that that has relation to the fact that Bull Falls has a reservoir or that there is one there, but rather to the question as to the capacity of installation which was proposed there and the use proposed to be made of it, and its location with reference to down stream riparian owners and the navigation of Kanawha River. For instance, the Bull Falls development would have a water capacity of about 15,500 second-feet at the point of maximum efficiency of its power installation, when the Hinton reservoir—that is the Hinton re-regulating reservoir is filled; about 16,000 or more, with the Hinton re-regulating reservoir drawn down. It would be as much as 18,200 second-feet when the Hinton reservoir is down but with the capacity at Bull Falls operating at full gate. That is a great deal of capacity to be thrown into a stream when the distance from down stream riparian owners is only about 10 miles to the nearest ones, and there are various ones located in a distance of 70 miles
2698 and the head of navigation is a distance of only 80 miles.

Q. Is it your understanding that, if they had a dam at Bull Falls, and were running at peak load, and they had no reregulating dam below, it would affect navigation?

By Mr. JACKSON. We object to the question, unless he specifies the size of the reservoir.

By Mr. THOMPSON:

Q. Taking the size of the reservoir described here. It was before the Commission.

A. There is still another factor, speaking of navigation.

Q. No, sir; can you answer that question "yes" or "no"?

A. No, sir.

Q. Read the question and see if it is not susceptible of such an answer?

(The question is read.)

By Mr. JACKSON. Show that the question was amended to show that you mean the size of the reservoir at Bulls Falls.

By Mr. THOMPSON:

Q. A reservoir of the Bull Falls size?

By Mr. JACKSON. And the same size of machinery.

By Mr. THOMPSON. Yes, sir.

A. One needs to draw into the answer the nature of the navigation facilities, on the Kanawha River.

Q. I don't think so. I did not ask you about the Kanawha River.

A. But I must make the answer.

Q. You must make the answer, but that question is simple enough for you to answer.

A. Not without a qualification as to the kind of navigation facilities.

Q. Do you object to making an answer?

A. Yes, sir.

By Mr. THOMPSON. All right, the record will show that.

By Mr. JACKSON. Let the witness answer the question. He says he cannot answer it "yes" or "no."

By the COURT. He says he cannot answer it "yes" or "no."

By Mr. JACKSON. He should permit him to answer it, however.

By Mr. THOMPSON:

Q. Assuming a reservoir the size which you were desirous of getting a license for at Bull Falls—that is, your company; and assuming it to be operated as you described it to the Commission in West Virginia—if it were operated at peak load, would that effect navigation down below on the Kanawha River?

A. You are asking or referring to navigation facilities as they existed in 1930, at the time of this testimony?

By Mr. THOMPSON:

Q. Well, say in 1930, yes.

2699 A. That is, with the old wicket type dams?

Q. Yes, sir.

A. That had potentialities of affecting navigation.

Q. Did it have potentialities for doing so, or would it actually affect navigation, according to your views, if they had London and Marmet and Winfield dams completed?

A. I don't know; I have not studied that.

Q. I will read from page 127——

A. (Interrupting.) I am inclined to think it would have some potentialities, under those circumstances.

Q. I will read from page 127 here [reading]:

"Q. Please describe the method of operating "dams in generating plants?

"A. That may involve to some degree repetition of what is contained in amendment of application on my earlier statement. The function of the downstream development is to turn out water in a reregulated or relatively equalized manner. The need for it arises from the plan of operating the upstream or Bull Falls development in such a way as to carry peak loads. The carrying of peak loads is an economic necessity. That is the project cannot be justified unless it does that. By the carrying of peak loads means the operation of a power station intermittently or

at least with great variation, as compared with what we style a base load or uniformly operated power station."

Q. (Continuing.) Did you make that statement?

A. I believe in essentially that form, yes.

Q. On page 128, I read as follows [reading]:

"The Bull Falls power station can be expected to operate during the hours of maximum demand upon the power system
2700 into which it is to feed practically those hours or the daylight hours, the working days, outside of those hours, perhaps, even during the noon hour"——

By the WITNESS. That read [indicating paper] "ourside."

By Mr. THOMPSON. That has been corrected to read "outside." [Reading] "perhaps, even during the noon hour, the output of power from the Bull Falls station will be curtailed or even cut down to zero. That means the outflow areas, but that intermittent output from the Bull Falls development will empty directly into the reservoir of Hinton development. In the Hinton development that water will be re-regulated. That is, although there will be a varying quantity put into the reservoir, the output will be relatively regular and uniform compared with the input. It is a necessary characteristic, as I believe I pointed out, that the down-stream reservoir, re-regulating reservoir, shall have sufficient storage capacity to allow for the accomplishment of that result. It does have that necessity. In brief, then, the method of operating the project will be to operate the Bull Falls development intermittently as a peak load carrier, and the down-stream plant, that is the Hinton power station, with relative uniformity."

Q. (Continuing.) Did you state that?

A. I think essentially in that form. I think in the next to the last sentence, the word "necessity," is an error, and that should read "capacity." There are probably other errors in it, but the general purport is what I stated, undoubtedly.

Q. You agree with the statement or say that you made
2701 the statement "the output of power from the Bull Falls station will be curtailed or even cut down to zero," page 128?

A. Under the circumstances, yes; if there was a power station near which could go to zero, it would be Bull Falls, with a re-regulating reservoir.

Q. I read at page 130 [reading]:

"For instance, the parent of the applicant company, the Appalachian Electric Power Company, has nearing completion plans for a power development at its so-called No. 6 site in Virginia, in Pulask county, upstream from Radford. It is proposed there to make a development which, in the general characteristics, will be much like the Bull Falls development. The storage capacity is

proposed to be 100,000 acre-feet. That is enough water to cover 100,000 acres to a depth of one foot. That may be compared with the capacity of the Bull Falls, in the amount of about 125,000 acre-feet, that is, that this Radford development alone will have about 80 per cent of as much as Bulls Falls. In addition it is logical to assume that there will be further development of storage upstream from the Radford power site in Virginia."

Q. (Continuing.) Did you make that statement?

A. I believe I made that in essence.

Q. If the Bull Falls project, being of similar construction and general characteristics, has need of a re-regulating reservoir, wouldn't the Radford project have need of a re-regulating reservoir?

A. That does not follow at all; no, sir. There is a distinct difference in that. The general characteristics are the same in that the height of the dam is sufficient in each case so it will be called a high dam, as compared with the Hinton re-regulating
2702 reservoir dam, which is only about 45 feet high and would be called relatively low—a relatively low dam. Certainly, so far as the dam is concerned, you would not say that the Hinton dam has the general characteristics of the Radford dam. The Bull Falls development is of the same general nature. The heights of the dams are roughly 118 feet, as compared with 143 feet. The reservoir capacity is not so tremendously different between Bull Falls and Radford, but Hinton would be entirely different in characteristic, as regards reservoir capacity.

The water capacity of the two stations, as proposed, would be radically different. Radford was proposed for 9,000 second-feet capacity.

Q. Are you reading from something?

A. From some figures that I have, yes.

Q. You are reading from notes, not simply figures, are you.

A. They are figures that I am reading. [indicating paper.]

Q. Where did you get them?

A. From an assistant.

Q. Where?

A. From an assistant that I had make them up for me.

Q. Who is the assistant?

A. It happened to be Mr. John Snethlage, in this case.

Q. He made them up yesterday, did he?

A. No, some of them were made the day before yesterday, and yesterday.

Q. Since we have examined Dr. Mead?

A. That is true, yes, sir. May I complete my answer?

Q. It would be better if you would complete it without reading from that paper.

By the COURT. He could not be expected to carry it in his head. He may read it.

A. I am not reading anything but the figures, which I do not carry in my memory. I was coming to the water—to the
2703 comparison of water or the discharge capacity. The Radford project is to be at a point of maximum efficiency at a capacity of approximately 9,000 second-feet; whereas, Bull Falls development would have a capacity varying from 15,500 to 16,200 second-feet, at the point of efficiency, the variation depending on the stage of water of the Hinton reservoir, so that the Bull Falls development has about ⅔ or is about ⅔ greater in its discharge capacity than Radford. That difference in reservoir capacity is not material, because, so far as the variable load or peak carrying load is concerned, all that is necessary is that there be sufficient water for a day or a few days pondage, and there is more than a few days in each.

2704 Another factor is the proximity of the Bull Falls development to Hinton and the possible trouble as regards down stream riparian owners or still further down navigation works. The Bull Falls development is within about 10 miles from the nearest power development of any other interest down stream, whereas, the Radford development is something like 90 miles away from it.

Comparing distances from the head of navigation on the Kanawha River, Bull Falls development would be a distance of 81 miles and Radford twice that far, and then as regards this distance there is the further fact that the steepness of the slope from Hinton to the Kanawha River is substantially greater than is the slope from Radford to Hinton or the Bull Falls site, and that has a definite effect upon the travel of power tides,—power tides would flatten out more in the upstream stretch than in the down-stream stretch.

Moreover, in 1930 wicket dams were in existence on the Kanawha River, and there was not an authorization of funds for construction of new navigation dams, and the wicket type dams, to the extent of eight on the Kanawha, were, therefore, very much in the forefront. With the Radford project, all have been displaced or will be by the time the project goes into operation. The statement that I made before the Public Service Commission of West Virginia took into account primarily the necessity as a business proposition, as I saw it—that there would be a change in the form of the development, and that was from a single dam, not at Bull Falls but at Hinton, which meant a proximity even greater to the interests generally down stream.

By Mr. THOMPSON:

Q. Are you through?

A. There is just one other point to be put into the picture and that is that the Bull Falls reservoir is located immediately adjacent to a re-regulating reservoir, and can be operated without consideration of any down stream rights whatsoever, because nothing intervenes. The water out of Bull Falls would empty into the head water at Hinton. In the case of Radford, there intervenes a great stretch of river, and there is within that stretch quite a difference from what there is below Bull Falls; there are various riparian considerations to be taken into account: One is Narrows stream plant of the Virginian Railway Company, of a capacity of 40,000 kilowatts, which depends for condensing water on the New River.

2705

Another is the Glenlyn steam plant of the Appalachian Electric Power Company, that has about 80,000 kilowatts, that is likewise dependent on the flow of New River for condensing water.

To be sure, in the latter case, there is no diversity of ownership, but there is certainly an absolute need of keeping enough water in the stream to provide circulating water for a large steam station.

Q. Do you speak with the authority of the corporation which you represent, the defendant, when you say, if I understand you, that, if the Government does not build this project, and your company is successful in this litigation, that your company will build it?

A. I see you do not distinguish between myself and that company. I am not a general agent for that company.

Q. You said yesterday——

A. I have not finished.

Q. You said yesterday that, if the Government did not build it, you people would build it—this company?

A. I did not use any words, I think, that were equivalent to "we people"; but in my opinion, from the status of the project, the money spent on it, the recommendations that I have made, and the manner in which these recommendations have been received, the growth of the system load—all of these things tell me that the project will go on to construction—would have gone on with construction in 1930, had the license from the State of West Virginia been granted.

2706

Q. Why has the Company been fooling with this project since 1912, and not gotten to the construction of it?

A. Well, it was not this company that did the fooling, if fooling was done. There were questions of State laws affecting that; the diversity of ownership and contentions that were not reconciled until the mergers in 1925 and 1926, in which the Appalachian Electric Power Company brought together the warring interests,

so to speak. It takes a long time to put a large water power development into operation or being. This Radford project was laid out, not in its present form, but was conceived in 1914 or 1915, and is not yet in existence.

Q. You made application about 1924 for a license, did you not.

A. The West Virginia Power Company, prior to my connection with the Company, made application for a license to the Public Service Commission of the State of West Virginia.

2707 By Mr. THOMPSON:

Q. You said, on page 6299 of this record, in your testimony, as follows [reading:]

"Q. State if you know whether or not this Bluestone project of the West Virginia Power Company is still included in the plans of the defendant and its affiliates with the developing of power stations on New River?"

By Mr. THOMPSON. And your answer is "Yes."

By Mr. JACKSON. That should be "for."

By Mr. THOMPSON:

Q. It is "with" here. Were you talking with authority or just talking then?

A. I was probably talking with knowledge.

Q. That was with knowledge of the plans of the company.

A. As they existed then.

Q. What I mean is, it was yesterday that you were talking?

A. I beg pardon; I thought you were quoting from the other transcript.

Q. This was yesterday.

A. I thought you were quoting from the transcript of the Public Service Commission. I do not understand it.

Q. I read the statement and your answer "Yes"; and I asked if you spoke with authority from the company or just talking as one, Mr. Scheidenhelm?

A. I was speaking with the knowledge which I have gained as a consulting engineer and in quite close contact in that capacity with that particular company and its affiliates.

2708 Q. Do you understand that they will, if they are victorious in this litigation—that they will go forward——

By Mr. JACKSON. What litigation?

By Mr. THOMPSON. The litigation before Judge McClintic right now.

A. In the broad sense, they will go ahead and build. As to the fact of whether they will go on in a week or a month or a year after the situation is cleared, I am not prepared to say that. No one would know that under the present status, when the water is so troubled.

Q. On page 138, I read.

A. Which record?

Q. Of the West Virginia Commission record. [Reading:]

"Q. I still don't catch your idea, Colonel. Do you mean to say that if the water is not necessary to carry the peak load that you would let the water down through the dam during the dry period in order to keep the normal flow going."

By Mr. THOMPSON. And your answer. [Reading:]

"That might be the case, and the power company might be altruistic enough for that, but the fact is there is a need for the peak load and the operators of the power system would only be too glad if they had more water available. They are limited by the available water."

"Q. That would depend on the demand for power, wouldn't it?

"A. But that cannot be conceived, reasonably, even in times of business depression, not to require all the output possible."

2709 By Mr. THOMPSON:

Q. (Continuing.) Is that a statement of yours?

A. Yes, sir; essentially that.

Q. I am reading from page 140 of the same record. [Reading:]

"Q. So that coming back to your point, if there were enough water available the power system operators would gladly get more than 50,000 kilowatts capacity out of the Bull Falls development during the low water, so that the water that is turned out will not be turned out for any altruistic motive, it will be turned out to generate energy. The load would demand it; it would be economically advantageous to do it. Now, the result of this upstream storage will be to make more water available. The Radford project is to go to construction practically concurrently with the Hinton development, assuming this Commission grants the license. They are economically related, as is the Bull Falls Development. Have I made myself clear?"

By Mr. THOMPSON:

Q. (Continuing.) Did you make that statement?

A. I think I did in essentially that form.

2710 Redirect examination by Mr. JACKSON:

Q. Col. Scheidenhelm, on cross-examination the Government had you identify, and offered in evidence as Government Exhibit 256, a letter dated October 16, 1931, written by you to Major Herman, District Engineer, Huntington, West Virginia, inquiring whether there had been any difficulty in maintaining pool level on the Kanawha River in 1930, and asked you whether you received any reply. I now show you a letter dated October 20, 1931, addressed to F. W. Scheidenhelm, signed by

United States Engineer Department, by F. B. Davis, and already marked "Defendant's Exhibit 514 for identification," his signature having been identified by the Government witness Teeter, and I ask you whether that Exhibit 514 is the reply which you received to Government Exhibit 256?

A. It is the reply.

Mr. JACKSON. We offer this Exhibit 514 in evidence. I will read it: "In reply to your letter dated October 16, 1931, regarding difficulties experienced in 1930 in maintaining pool levels above Dams Nos. 2, 3, and 4 on Kanawha River, you are hereby advised that difficulties were experienced in maintaining pool levels above Nos. 2, and 3. However, the deficiency in pool levels was not due to the low discharge in the river, but to missing timbers and stone filling at the tops of the fixed crib dams. After repairs were made, the pools were a little low at times, due to leakage through the old crib dams. No particular trouble was experienced in holding pools above movable dams below, though considerable caulking was required to prevent excessive leakage."

At this time I produce and ask to have marked for identification House Document No. 306, 74th Congress, First Session, entitled: "Ohio River. Letter from the Secretary of War transmitting, pursuant to Section 1 of the River and Harbor Act approved January 21, 1927, and Section 10 of the Flood Control Act approved May 15, 1928, a letter from the Chief of Engineers, United States Army, dated August 14, 1935, submitting a report, together with accompanying papers and illustrations, containing a general plan for the improvement of the Ohio River for the purposes of navigation and efficient development of its water power, the control of floods, and the needs of irrigation."

(NOTE.—This document is filed marked "Defendant's Exhibit No. 601 for identification.")

Mr. JACKSON. I would like to withdraw Exhibit 514 and substitute a photostatic copy.

From page 146 of "Defendant's Exhibit 601 for identification" I offer in evidence paragraph 263 [reading:]

"263. Low water flow. The flow of the Ohio River was, in general, lower during the fall of 1930 than it has ever been since records of this nature have been kept. Table 45, appendix A, part 4, contains estimates of low water flow at all dams in the section of the river under consideration." A foot note shows Table 45, appendix A, "Not printed."

I now produce a photostat bearing the title at the top, "Table No. 45. Low water flow—Ohio River, regulated by reservoirs under Plan 1," and ask to have it marked "Defendant's Exhibit 602 for identification."

(NOTE.—The paper referred to was so marked.)

By Mr. JACKSON:

Q. Col. Scheidenhelm, I show you Defendant's Exhibit No. 602 for identification, and ask you whether that is a photostatic copy of Table 45, Appendix A, referred to in paragraph 263 of Exhibit 601 for identification.

A. It was furnished to me by the office of the Chief of Engineers of the Army as such, and it bears all the earmarks, and I accepted it as such.

Q. Was that delivered to you by the Chief of Engineers in response to your request for that information?

A. It was.

Mr. JACKSON. We offer in evidence this Exhibit 602.

Mr. THOMPSON. If the Court please, we have no objection, subject to examination, to this exhibit being marked for identification at this time.

We would like to look it over.

By Mr. JACKSON:

Q. Col. Scheidenhelm, during your cross-examination you were asked whether, in particular, waves Nos. 1, 2, 3, and 4 of the 1930 wave tests were not rectangular in form with substantially perpendicular faces. Is that a fairly accurate description of those waves as they were initiated?

A. Quite so.

Q. State whether or not in your opinion there is any
2711 other form of wave with the same volume of water which could produce any more severe effect in passing downstream?

A. Speaking of form of wave at the point of propogation, waves which have form other than rectangular, and particularly triangular forms, tend to lose amplitude and volume more rapidly than do waves of the rectangular form. That is the most severe form.

By Mr. JACKSON:

Q. What relation does the present answer you have just stated have relative to the persistency of the wave?

A. The wave which in its original form of propogation is of the rectangular or block form, tends to be more persistent in its travel down-stream as compared with the travel from the same point of initiation through the same course and with the same volume of a wave of a different form.

Q. Taking into account all of the means of wave propogation available to you at Byllesby and Buck for the purposes of these 1930 tests, could you have caused the propogation of any waves which, in their effect on the Kanawha River, would have been more

severe than those which were actually propogated during those tests?

A. It was the intention to set up the most severe condition. As far as I knew then, and as far as I know now, the available facilities by way of power station, or reservoir, or pondage, and taking into account water supply, does not permit the doing of anything by way of wave propogation which would have had a more severe effect in the Kanawha River.

Q. How does the volume of wave 11, in the 1930 tests, compare with the discharge shown on Defendant's Exhibit 594?

A. By wave No. 11, I presume you mean the large wave centering on March 22 at Ivanhoe?

Q. That is what I understand.

A. At Ivanhoe, that wave had a volume almost equal to the total volume of discharge shown for the Radford power station wave, exhibited as No. 594. That is, the latter has a volume
2712 of 3,000 second-feet days; the wave of the 1930 series had a volume of 2,900 second-feet days; wave 11 had a volume substantially greater than the daytime portion of the Radford discharge on Exhibit 594. Actually, wave 11, as shown by Government Exhibit 227, was preceded in point of time by a small wave centering approximately on midnight of March 21–22, and that small wave approximates, to a substantial extent, the evening portion of the discharge shown on Exhibit 594.

At Ivanhoe, that small wave had a volume of approximately 500 second feet days. Thus that small wave, plus the succeeding wave 11, had a combined total of 3,400 second-feet days, which volume compares with the 3,000 second-feet day volume of the form of discharge for the Radford power station shown on Exhibit 594.

Q. Have you finished your comparison?

A. I have.

Q. On your cross-examination you testified that the average amplitude in stage of the 18 waves of 1930 tests, at Lock No. 2 on the Kanawha River, was approximately five inches. What was the average period of time which these waves required to rise the five inches in amplitude to which they attained at Lock No. 2?

A. I do not have the figures for the 18 waves because four of the 18 (13–A, 13B, 14–A, and 14–B) were practicalyy negligible at Lock No. 2. However, eliminating those four waves and treating the remaining fourteen, I find the average time of rising for the fourteen was about five and a half hours, and the average time for the fall was nineteen hours. That is the average duration of the fourteen waves was twenty-four and a half hours, approximately.

Another reason for eliminating the four waves which, on Exhibit 227, are designated 13–A, 13–B, 14–A, and 14–B, is they were

propogated near twelve hours apart, and in that respect differ substantially from the periods of propogation of the remainder of the number of waves.

By Mr. JACKSON:

Q. How does the total average duration of the fourteen waves compare with the periods of release of possible power tides at Radford?

2713 A. In general, power tides which might be released at Radford would be twenty-four hours apart. That would obtain during all of the successive days when waves are released; or, to put it more accurately, when there is a variable flow discharge carrying some part of the system peak.

Q. Then would the comparison be between the 24½ hours and the 24 hours in that respect?

A. Yes; it would be on that basis. It just happens that the average interval between the release of waves at Buck and Byllesby for the fourteen I have mentioned is just a trifle over 24 hours.

Q. What was the average length of those fourteen waves of the 1930 power tests at Lock No. 2?

A. About 100 miles.

Q. Have you a chart which would graphically illustrate something of the actual form of these so-called power waves or tides at Lock No. 2?

A. We have a chart which depicts a wave on a full size vertical scale.

The COURT. Are you not going back to the direct examination?

Mr. JACKSON. I do not think so, but this is the last question I have on waves. It is only intended as illustrative, but if the Court thinks I am going too far, I will not press it.

Mr. THOMPSON. I object to any testimony with regard to the exhibit which it is proposed to introduce, as going beyond the limitations of redirect examination.

Mr. JACKSON. All right. The defendant offers at this time, as a part of its re-direct and explanatory of the cross-examination as to the form of the so-called tides or waves, to prove graphically through this witness that such power tides or waves, when plotted in accordance with their actual size and form, will show a total rise at Lock No. 2 of possibly four or five inches, with a length of approximately 105 miles, so that the true picture of the wave will be a picture of a wave 105 miles long, rising over a period of many miles to a maximum height of four or five inches and receding over a distance of many miles to the original level.

Mr. THOMPSON. We object to counsel's description, as it is not based on the testimony in this case.

The COURT. That is what he is offering to prove.

Mr. JACKSON. I assume that offer is declined, and that we have our exception?

The COURT. Yes.

By Mr. JACKSON:

Q. On your cross-examination attention was directed to Government Exhibit 226, and particularly to the computed output from the Radford station for five week days as shown on that exhibit; will you please state what volume of water is included in the discharge of the Radford station, as shown on Government Exhibit 226, for each of the week days?

A. For Monday, October 24th, 3,620 second-feet days, approximately; Tuesday, 3,750 second-feet days; Wednesday, 3,900 second-feet days; Thursday 3,620 second-feet days; Friday, 3,400 second-feet days. Those are approximate figures.

Q. Col. Scheidenhelm, I show you Government Exhibit 229 and Government Exhibit 230, and ask you to state briefly whether there are any errors in those exhibits?

A. I find some discrepancies in them.

Q. State them briefly?

A. Some of the discrepancies I find have already been referred to in the testimony, and I shall not touch upon them unless
2714 counsel desire it. In addition, in the lower diagram on Exhibit 229, comparison of that exhibit with the original automatic gage chart, shows that the pool level at the upper end of pool No. 6 has been plotted uniformly at a level one-half foot below that actually shown by the chart.

In the case of Exhibit 230, I find apparent errors in the plotting of the elevation at Marmet dam (that is at the upper end of pool No. 6), for each of the respective times indicated. In one case, the error is of what I would style negligible extent; In the other cases they are not negligible. The maximum is about 1.3 feet.

Q. That is the nature of the errors? Are they in connection with the levels?

A. The elevations I find to be incorrectly plotted, a part of the error lying in the fact that chart 229 has been plotted one-half foot in error from the original gage chart, and the remaining errors I cannot account for.

Recross examination by Mr. THOMPSON:

Q. Colonel, on Government Exhibit 229, about which you have just testified, and on which you say there is an error, is that error of any consequence with relation to the purpose for which this exhibit was introduced?

A. As far as conceras the plotting of the upper end of Dam No. 6 pool on Exhibit 229, I would not consider that of consequence. I do consider it of consequence in that it forms basic data for the plotting on Exhibit 230.

Q. Do you regard what you assert to be an error, carried over from Government Exhibits 229 and 230 with respect to No. 6 pool, to be a serious one, or material, in view of the purpose of this exhibit in this case, namely, to show the profile of the water surface in Marmet pool?

A. Of course, it does not correctly portray the water surface in the Marmet pool, but I would surmise the purpose of Exhibit 230 is to show that fluctuations had occurred in Dam No. 6 pool
2715 due to the operation of the Marmet dam, and, in that respect, the errors are such as do not wipe out the fact that there are such fluctuations due to the Marmet dam, but it does change substantially the quantitative extent of those changes, as shown on Exhibit 230.

Q. The errors which you say appear on Government Exhibit 230 with respect to pool No. 6 do not affect the representation with respect to the Marmet pool, do they?

A. They do not, although in that particular representation there is the error pointed out at some time during the testimony as regards the so-called first oscillation at 4 P. M., which I did not mention this morning.

Q. And that error has been previously alluded to in testimony as two-tenths of a foot, has it not?

A. I believe that is true.

Q. You would not call that material, would you?

A. It is about one-third of the total amount previously shown.

Q. That would not be material, would it?

A. I do not think it is material upon the question that there are no fluctuations now caused in the navigation pools by the Marmet and London dams. It merely has to do with quantitative extent of these variations.

Q. You have reference to Government Exhibit 227. You have just testified, I believe, that wave No. 11 was comparable in volume with the wave on Defendant's Exhibit 594, if you include the preceding wave between 10 and 11; isn't that correct?

A. I believe I stated that the total volume of wave 11, without the small waves, is approximately equal to the total volume of the discharge shown on Exhibit 594. If the small wave be included, then the combined total, as per Exhibit 227, is somewhat greater than the total of the discharge from the Radford station, as indicated on Exhibit 594.

Q. On 11, how long is the time of discharge?

A. Wave 11, as measured at Ivanhoe in terms of ampli-
2716 tude in stage or feet, has a slightly complicating feature at the bottom of the main wave. If one considers the duration of time just at the top of that small amount of preliminary discharge presumably caused by some discharge over the gates at Byllesby and Buck, the duration would be roughly 12½ hours. If one takes into account that preliminary leakage, one might call it, over the top of the gate, the duration would be about 16½ hours.

Q. And, if you do not take that into account, it is 11½?

A. I stated about 12½.

Q. Now then, on No. 594, it is about 16½?

A. It is about 16½ hours, as I recall it.

Q. Colonel, wouldn't the Radford project be carrying a variable load more than 90 percent of the time?

A. I never made any estimate of it. I doubt that.

Q. What would you say?

A. I say, I never made any estimate of it.

Q. You have thought about it, haven't you?

A. Not in those terms.

Q. What percentage of time does 9000 second feet obtain at the Radford dam site?

A. According to natural flow conditions on an approximate basis a flow of 9,000 second-feet, apparently would exist about five percent of the time.

Q. That would mean there would be a flow of less than 9,000 second-feet for 95% of the time?

By Mr. JACKSON: I object to the question as not proper recross examination.

By the COURT. He may answer.

By Mr. JACKSON. Exception.

A. That is true if under natural conditions, not under operating conditions there, neither the periods of storage in the reservoir or the periods of low flow when there would be draft upon the reservoir—the latter would not affect the situation greatly but the former would. Certainly when a power station such as Radford has a full reservoir and a flow of around 6,000
2717 second-feet and up, perhaps even 5,000 second-feet and up, the variable flow set up by that would be comparatively little or nothing. I have not reasoned that thing through sufficiently to express it quantitatively.

Redirect examination by Mr. JACKSON:

Q. Col. Scheidenhelm, in connection with the Grounding No. 1, testified to by the witness Elsey, Witness Elsey has furnished data to the effect that this grounding occurred December 28,

1935, at 8 a. m. The tow was four barges, the draft 6 feet, and under the heading "exact grounding" the statement is "ice gorge". Have you investigated the condition of the river and of the operations of the Marmet power station on that date?

A. I have.

Q. Will you describe the condition of the river and the operation of the Marmet power station at a date corresponding to this grounding?

A. Prior to the time of the stated grounding the water levels at the foot of the Marmet dam and locks had, for at least 24 hours, been at a level which, at a minimum, was about 1½ foot above the normal pool level at Pool #6. There was no variable load or peak carrying operation at the Marmet hydro station. The outflow from the Marmet power station was the only power outflow which could have had any conceivable bearing upon the question as to whether the grounding was caused or not caused by power station outflow. That is, the London Power Station outflow could have had no relation. The operations of the Marmet power station could not have been the cause of the grounding.

Q. In connection with grounding No. 5, testified to by the witness Elsey, the witness has produced a statement purporting to come from a record to the effect that this grounding occurred May 20, 1936, at 11:10 a. m., that there was a tow of eight barges, the draft of loading was 6½ feet, and the exact grounding was Lock 10. Have you investigated all the conditions of the river and the operations of the Marmet Power Station at that time?

A. I have.

By Mr. JACKSON:

Q. Will you please describe the condition of the river and the operations of the Marmet power station at the time corresponding to the date given by the witness Elsey for grounding No. 5?

By Mr. THOMPSON. Your Honor. I further object on the ground that he isn't showing the source from which he gets this information.

By Mr. JACKSON. At the time the witness Elsey was on the stand he undertook to testify to six alleged groundings of tows in the Kanawha River, which were designated by number for convenience, grounding #1 being testified to as having occurred about the middle of December, 1935, below lock #10, later corrected to lock #8. Grounding #2 was testified to as having occurred about seven or eight days later, below Lock #10. Grounding #3 was testified to as having occurred below lock #10 in January, 1936. Grounding #4 was testified to as having occurred below lock #11 in April, 1936. Grounding #5 was testified to as

having occurred below lock #11 in May, 1936. Grounding #6 was claimed to have occurred around July 1, 1936, below lock #10. We asked the witness to produce or supply us with the exact dates of those six alleged groundings, the number of barges included in the tow, the draft to which they were loaded, and the exact location of the alleged groundings, and I now call upon Government counsel to supply that for those six alleged groundings or else move the testimony as regards those be stricken from the record.

By Mr. GATCHELL. Of course, your honor, in the direct testimony of Captain Elsey no request was made upon him for the furnishing of any record in substantiation of his statement he had six groundings on some dates within the past year. That request was made by counsel for the defendant, and on cross examination Captain Elsey supplied dates as nearly as he could recall. We attempted to secure through Captain Elsey the original log books from the company for which he worked, the Raymond City Coal and Transportation Company, and the Huntington District Engineer office as well, and we were unable to get the original log books. He has not supplied them and apparently cannot obtain them. They will not let those log books go out of the Raymond City Coal and Transportation boats——

By Mr. JACKSON. Boats?

By Mr. GATCHELL. I mean out of their office. We have received a letter from Captain Elsey dated August 18, 1936, addressed to Lt. Col. John F. Conklin, and if the defendant cares to have me do so I will read that, or else just offer it without reading it, supplying the dates as nearly corresponding as he could with the dates mentioned in his testimony. He gives a number of dates.

By Mr. JACKSON. Before you read them may I say——

By the COURT. Have you seen the letter?

By Mr. JACKSON. Yes, sir; and the situation is this. He purports to give one record of a grounding in December, 1935. While it is a good many days off from his grounding #1, I would raise no question about that, because a matter of approximation. He then shows no possible date for grounding that could possibly relate to his alleged groundings 2, 3 and 4, which occurred, according to him, at the very end of December, January, and one in April. The groundings he shows after the alleged grounding of April is one of May 20, 1936. His grounding #5 was alleged to have occurred in May, 1936, so if there is any data to support it, it must pre-empt that. He has a record for June 28, or at least he says he has, and sends the data he says was taken, that would roughly correspond to his July 1, 1936. Although he could produce nothing corresponding to 2, 3 and 4, he undertakes to list eight other additional groundings, which the Government wants to put in evidence without subjecting him to cross examination,

and it is our position we are entitled to any data available for those six groundings, and if none, we are entitled to the statement there are none, so where there is any data we may show the condition of the river, and the Government has no right to inject into this record evidence of alleged groundings at other times without producing any witness and submitting him to cross examination, merely because they have failed to supply data that their witness was asked to supply and which he said he could supply in substantiation of his six alleged groundings.

By the COURT. The data in that letter is to be received as to so many of those incidents, these groundings as you refer to them, as can be identified with ones to which the witness testified on the stand. In other words, the situation will be he testified to a certain number of these incidents while he was a witness on the stand, and was asked to furnish more detailed information as to the dates, location, draft of the barges, which were grounded, and as to the nature and extent of the load, and he has furnished it as to three of those.

By Mr. JACKSON. Then as to grounding #1 the closest approximation to that, the data furnished by the witness Elsey, is as follows:

Date, December 28, 1935. Hour, 8:00 A. M. Number of barges, four. Draft six feet. Exact grounding, ice gorge.

As to grounding #5, the witness Elsey has furnished the following information:

Date, May 20, 1936. Hour, 11:10 A. M. Number of barges, eight. Draft, 6½ feet. Exact grounding, Lock #10.

As to grounding #6, the witness Elsey has furnished the following information:

Date, June 28, 1936. Hour 8:55 A. M. Number of barges, eight. Draft, 6.5 feet. Exact grounding, Lock #11, with notation "double trip."

By Mr. GATCHELL. And of course your Honor the note appearing at the bottom of this should also be in the record, although the whole letter is of course to be received by your Honor. That note reads as follows:

"NOTE. December 1935 not noted on Manifest.

"Seven days later not recorded.

"Stages below Marmet not noted on Manifest.

"Record can be had Marmet dam and Point Pleasant, West Virginia."

Now in that connection he said that he had recalled an instance in which there had been a rise in the stage on the Kanawha River of about three feet over night. We requested him to supply the date this occurred at the request of counsel for defendant. He has not done so, but we have been informed by the Huntington office

on May 18th there was a rise on the lower gage at Marmet of 2.6 feet, between 7:00 P. M., and 10:00 A. M., on May 25, 1936, there was a rise in stage of 2.1 feet between 8:00 P. M., and 10:00 A. M. on the same gage, and on May 26, 1936, there was a rise in stage of 2.4 feet between 4:00 A. M. and 10:00 A. M.

By Mr. JACKSON. We object to that because there is nothing produced by the witness Elsey in support of his statement.

By the COURT. That information you have is from another source, has nothing to do with Elsey's testimony?

By Mr. GATCHELL. Capt. Elsey testified that he recalled the rise of three feet over night and counsel for defendent requested him to supply the data on which that occurred and, if he could not get it, to secure it from some source.

By Mr. JACKSON. I didn't request him to do that. I requested him to supply it.

By Mr. GATCHELL. Counsel for defendant requested him to supply it, and they have asked me to secure that data from Capt. Elsey if I could do so and if I couldn't do so to call the Huntington office, that it had been supplied by the Huntington office.

By Mr. JACKSON. What Huntington office are you referring to?

By Mr. GATCHELL. The District Engineer's office.

By Mr. JACKSON. I object to the acceptance of that statement.

By the COURT. Does it relate to this particular incident that the witness Elsey testified about?

By Mr. JACKSON. He testified about having observed a rise of three feet. I asked him to supply the date. He has not done so. Counsel comes in and reads three dates. I don't know whether he thought he would testify to three dates or not, and he says it is from information he has collected from the Huntington Engineer office. If the Huntington engineer office wants to produce testimony, we will be glad to have them here.

By Mr. GATCHELL. Here is the colloquy, Your Honor, page 3075 of the record:

"Q. And you made a statement that you saw three feet difference below the Marmet dam, didn't you?

"A. I didn't say that I saw it.

"Q. What did you say?

"A. I said I received the Government reports of the river being from three feet and then showing a gage of three inches to four inches at the mouth.

"Q. You mean you received a Government report that showed that the gage was three feet different from what?

"A. Three feet higher than it was the day before at the time that I had received my marks from the previous day.

"Q. And will you give the date of that?

"A. I haven't got the date of that; no, sir.

"Q. Will your records show it?

"A. Yes, sir; the United States Government records will show that.

"Q. Do you have the record?

"A. I don't have that record unless I can get the proper date.

"Q. Will you find it the same way you found it before and send us the date?

"A. Yes, sir; I will try to locate it."

By Mr. JACKSON. He hasn't done so.

By the COURT. Now you come in here with—what is it, Mr. Gatchell?

By Mr. GATCHELL. I come in here with the record supplied by the Huntington office.

By the COURT. There is nothing to indicate that it relates to the time or the incident of which that witness spoke?

By Mr. GATCHELL. He didn't relate any time, Your Honor. That is the difficulty.

By Mr. JACKSON. We ask him to do that.

By Mr. GATCHELL. He said he would get it.

By Mr. JACKSON. But he didn't.

By the COURT. The objection to the introduction of that is sustained.

By Mr. GATCHELL. Will Your Honor grant us an exception, please? Do I understand the letter from Capt. Elsey and the list attached is received by Your Honor?

By the COURT. As to those particular incidents, as to which he testified.

By Mr. GATCHELL. Will Your Honor grant us an exception to the receipt for that purpose?

By the COURT. Yes.

2718 By the COURT. I think perhaps he had better show the source.

By Mr. JACKSON:

Q. Will you state the source of the information that you have about the condition of the river and the operations of the Marmet Power Station?

A. The primary sources as to the elevations of pool levels at the foot of the Marmet dam, that is, at the head of the No. 6 pool, are the lock readings for the downstream gages at the Marmet dam.

By Mr. THOMPSON:

Q. Have you those lock readings here?

A. The source of the information as to peak carrying operations is my interpretation of those downstream lock gage readings as representing variable operation, which interpretation on my

part is based upon my knowledge of the operation of the Marmet plant and the fluctuations which result from it in its tail-water, that is, in the pool level at the head of the No. 6 pool. The Marmet power station, under present conditions, causes fluctuations which, assuming at the beginning a pool level in No. 6 at the normal elevation or nominal elevation of that pool, extend to approximately three feet above that pool level. That is a normal, a necessary, condition resulting from the natural conditions in the river and the discharge capacity of the Marmet power station.

By Mr. THOMPSON. At this time I move to strike all of that testimony as the witness has said he ha based it upon readings of certain gages, I presume, and we haven't those gagings before us.

By the COURT. I don't know whether he has them or not.

By Mr. THOMPSON. I have asked him to produce them.

By Mr. THOMPSON:

Q. Are they here?

A. There are here records which were taken from the Lock Master's Office and which were taken in that form and
2719 relied upon by me, under the understanding between counsel, as I understood it, that records of that kind could be used without producing the originals and subject to the check of either party to this controversy from the original data.

By Mr. JACKSON:

Q. Will you please describe the condition of the river and the operations of the Marmet power station for the date apparently given by the witness Elsey for grounding No. 5, that is, May 20, 1936, at 11:10 a. m.?

A. I have not investigated downstream gage readings beyond those at the head of the No. 6 pool. I have been concerned with what appeared to me to be the obviously pertinent matter,
2720 namely, the question as to whether No. 6 pool, at the head thereof, had an elevation above the normal pool elevation for a sufficiently long period in advance of the stated time of grounding, such that no inadequacy of water supply at Marmet could have been the cause of inadequate pool levels downstream. That involves the time of lag, that is the time of travel of water from the foot of the Marmet dam to the respective points of grounding. I do not know exactly the time of travel. It would require a refined investigation. In my judgment it is within eight to sixteen hours, with regard to locks 10 and 11, and less for locks closer to Marmet dam. I have taken into account the water elevations at the foot of the Marmet dam for a period of at least 24 hours, in each case, so as to cover sufficiently the total period.

A. The stated draft of the barges is six inches greater than the project depth. There had been some peak carrying operations at the Marmet power station prior——

A. (Continuing.) To the time of the grounding, but there had been no variable load of any material extent for more than 24 hours prior to the time of the grounding and within that period of 24 hours prior to the time of the grounding—my statement is incorrect, in part. I should like to re-state beginning with that portion of my statement concerning peak carrying operations at the Marmet plant. Within 24 hours prior to the time of the grounding there had been peak carrying operations at the Marmet station. Within that same 24 hours the minimum excess of water level at the downstream lock gauge at Marmet, that is, at the up-stream end of the No. 6 pool, over and above the nominal pool level, had not been less than about 9/10 of a foot.

By Mr. JACKSON:

Q. The level of the No. 6 pool at the upper end was 9/10 of a foot above the normal level?

A. A minimum of about 9/10 of a foot above the normal level.

Q. What would be the relation between the maintenance of that level in pool No. 6, and the levels of the pools downstream?

2721 A. There could have, in my opinion, been no inadequate water level below the normal pool level, that is, below the project levels at any of the downstream pools, due to conditions at the foot of the Marmet dam, or due to the operation of the Marmet power station.

Q. Colonel, witness Elsey, in connection with an alleged grounding No. 6, has furnished information to the effect that this grounding occurred June 28th, 1936, at 8:55 a. m., with a tow of eight barges loaded to a draft of 6½ feet, and at Lock No. 11, with the notation "double trip." Have you studied the conditions of the river and the operations of the Marmet power station at the time given by the witness Elsey for the sixth grounding, that is, June 28, 1936, at 8:55 a. m.?

By Mr. JACKSON:

Q. Is the source of your study the same as you stated in connection with Grounding No. 5?

A. The sources are the same as I have stated in respect of the two groundings concerning which I have given the results of my investigation.

Q. Please describe the condition of the river and the operations of the Marmet power station at the time given by the Witness Elsey for his alleged Grounding No. 6, that is June 28, 1936?

A. That grounding, am I to understand, is stated to have occurred at 8:55 in the morning?

Q. Yes.

A. In the case of the June 28th reported grounding at 8:55 a. m., the barges are reported to have been loaded in excess of the project depth by six inches. For more than 24 hours prior to that grounding there had been no peak carrying operation at the Marmet power station and the water level at the head of Pool No. 6, had not been below an elevation of approximately 8 inches above the normal pool level.

Recross examination by Mr. THOMPSON:

Q. Upon what data did you base these statements that you made?

A. The data which I have previously stated, namely, the downstream lock gage readings at the Marmet locks.

Q. Have you those downstream lock gage readings with you?

2722 A. Not in their original form. I have them charted.

Q. In what kind of form have you them?

A. I have them charted in a form taken from the originals.

Q. And did you make up that chart?

A. I did not.

Q. So that somebody else made it up for you, did they?

A. That is correct.

Q. And you assume that they made it correctly?

A. That is true.

Q. Have you got those charts which they made up?

A. I have.

Q. You have them?

A. I have them.

Q. How long have you had them?

A. I do not recall. I did not have them in my possession for this particular purpose.

Q. Have you had them a month?

A. I had the gage readings at these locks prepared as a routine matter and kept up to date since practically the plants have been in operation.

Q. Have you had them a month?

A. Not in their present form.

Q. In any form?

A. I probably have.

Q. And who got them up for you?

A. They were prepared by H. E. McCormick.

Q. And where is Mr. McCormick?

A. His headquarters are at Charleston, W. Va.

Q. Is he there now?

A. I do not know.

Q. Is he employed by the Appalachian Electric Power Company?

A. He is.

Q. Will you produce them now?

2723 A. Produce them or him?

Q. Produce these records which he got up for you?

A. Yes.

Q. All right, produce them.

By the COURT:

Q. Col. Scheidenhelm, have you any records of the stream flow at Kanawha Falls for these dates or for, we will say, 48 hours ahead of the dates that have been mentioned as the dates of these groundings?

A. I believe I have, sir. They may be approximate.

By Mr. THOMPSON:

Q. Did you use the gagings at Kanawha Falls in this consideration?

A. I am trying to answer the question of the Court, if you don't mind. I cannot lay my hands at the moment upon discharge estimates at Kanawha Falls.

By the COURT:

Q. For any other gaging station up-stream?

A. I have corresponding estimates of flow at Marmet, at the dam.

By Mr. JACKSON. It was our thought that if the flow through Marmet was adequate, any conditions down-stream would be regulated by that. It wouldn't matter what was above because that is the controlling flow.

By Mr. THOMPSON. I object to the argument of counsel and ask that it be stricken out.

By the COURT. That is probably correct, but I wanted to know the information from any of the gaging stations, both Marmet and London. I will go ahead and hear what Col. Scheidenhelm has to say.

A. I will furnish the other as soon as I can get it, but, in the meantime, at Marmet in connection with the grounding stated to have taken place December 28, 1935, the flow past Marmet was in the neighborhood of 4,200 second feet.

By Mr. THOMPSON:

Q. Was that continuously?

A. In the case of the grounding stated to have taken place May 20, 1936, the flow past Marmet dam was in the neighborhood of 3,000 to 4,000 second-feet naturally, but the peaking operation there may have cut the flow by in the neighborhood

of 2,000 second-feet. The fact that there was a water level above the #6 pool level shows that there was flow past the Marmet dam. In the case of the grounding stated to have occurred on the morning of June 28th, the flow at Marmet was in the neighborhood of 2,500 second-feet.

2724 A. I have available here the gage heights at Kanawha Falls but the conversion of those gage heights into stream flow on the basis of the rating tables of the United States Geological Survey for that station I do not have at hand and it is not a simple matter because of the fact that it is a recording gage and it reveals the fluctuations from hour to hour or even minute to minute of flow at that station.

(Exhibit 603, being cover page and page 267 of document entitled "The Ohio River,—charts, drawings and description of features affecting navigation, War Department rules and regulations for the river and its tributaries; navigable depths and tables of distances for tributaries. (Compiled under direction of the Chief of Engineers, United States Army, and the District Engineer, Cincinnati, Ohio)," was offered in evidence.)

(Exhibits 586, 588, 589 and 590, re-offered for purpose of showing the position and action taken by defendant and as evidence of the position and intent of the defendant.)

(Exhibit 507, being Gage Recorder Sheet of Kanawha River at Kanawha Falls, West Virginia, for the period July 6-13, 1936 was offered in evidence.)

(Exhibit 506, being "Seventh Annual Report of the Federal Power Commission" 1927 was offered in evidence.)

(Exhibit 557, being pages 140, 141 of Journal of the Virginia House of Delegates for 1817–1818 was offered in evidence.)

F. W. SCHEIDENHELM (recalled)

By the COURT. I want to know the low water time in the river.

By the WITNESS. On December 28th and for the preceding forty hours, at Kanawha Falls gage, the minimum flow was 3,900 second-feet; the maximum flow on December 28th, was approximately 4,600 second-feet. On May 20th, and for the preceding 40 hours, the minimum flow at Kanawha Falls was approximately 6,250 second-feet, and the maximum flow on May 20th was 12,000 second-feet approximately. On June 28th and for the preceding 40 hours, the minimum flow at Kanawha Falls was 2,360 second-feet, and the maximum flow on June 28th at Kanawha Falls was approximately 2,800 second-feet.

By Mr. JACKSON:

Q. Is that 40 hours preceding the grounding in each instance?

A. It was preceding the grounding.

2725 *Section 3. Plaintiff's rebuttal testimony*

JOHN E. CARPENTER

Direct examination by Mr. THOMPSON:

Q. Mr. Carpenter, where do you reside?
A. Point Pleasant, West Virginia.
Q. What is your occupation?
A. Associate Superintendent of locks and dams on the Kanawha River, part of the Ohio and Big Sandy River.
Q. You are a part of the force of the United States Government, are you?
A. That is right.
Q. To whom do you report?
A. I report to Mr. Castle, the Chief of Operations.
Q. Of what?
A. Of anything that happens.

By the COURT:

Q. Do you have any subordinates working under you?
A. Yes, sir.

By the COURT:

Q. When they are more than five feet away, how do you communicate with them; ever have occasion to shout at them, or make yourself heard?
A. Sometimes, yes, sir.

By the COURT:

Q. What is Mr. Castle's title?
A. Chief of Operations.
Q. Of what?
A. Of the locks and dams in the Huntington Engineer Office District.
Q. Is he a member of the force of the United States District Engineer office?
A. He is.

2726 Q. How long have you held your present position?
A. Since 1932.
Q. Prior to 1932, what did you do?
A. I was in charge part of the time of all of the operation, and part of the time on some construction work of locks and dams.
Q. These locks and dams you speak of, you are referring always to locks and dams of the United States, are you?
A. Yes, sir.
Q. How long have you been on the Kanawha River, how many years?

A. I was on the Kanawha River from 1905 to 1911, then later ack in 1932.

Q. Who have you been working for since 1905?

A. U. S. Government, Engineer Department.

Q. What are you specific duties?

A. Operation and care of the dams, that is, maintenance and epairs and to keep normal project depths.

Q. A witness here by the name of Putnam testified that the rate f increase in flow in the Marmet pool and the Winfield pool, ould have no effect upon navigation until a discharge reached point which he termed obstructive; also that the rate of decrease flow in those pools was immaterial, so long as the pools were not rawn down below normal project elevation, allowing for lockage, eakage and evaporation. In that connection, have you investiated the causes of any navigation difficulties on the Kanawha iver?

A. Yes, sir.

Q. In what respect do you investigate these matters?

A. When boats go aground, any fluctuation whatsoever that ould cause navigation any trouble, such as boats being grounded n chutes, in their landings, or in any way that would cause rouble.

Q. How do you know these boats are aground?

A. By going to them.

Q. Who lets you know?

727 A. Either the lock masters or the companies themselves, the owners.

Q. How do they communicate with you?

A. By telephone.

Q. And what do you do after you get the communication by elephone?

A. Immediately go to the place of trouble.

Q. Have you had any complaints from pool #8?

A. Yes, sir.

By Mr. JACKSON:

Q. When? What were the character of these complaints?

A. That in the landing of the——

Q. Won't you speak a little louder?

A. In the landing of the Raymond City Transportation Comany, I have had complaints from them, on account of the water eing down, that is, fluctuation of it.

Q. Is that in pool #8?

A. Yes, sir.

Q. Did you investigate that?

A. Yes, sir.

Q. What was the cause for your investigation?
A. The fluctuations of the pool.
Q. The fluctuations of the pool?
A. Yes, sir.
Q. How do you know that?
A. By being there at the time and knowing what the pools were doing.
Q. Was the Marmet power plant operating at that time?
A. Yes, sir.
Q. Did you or did you not determine the cause of that fluctuation you speak of?
A. That is what I thought it was, from the power plant.
Q. From the power plant?
A. Yes, sir.
2728 Q. Did you go to the power plant?
A. I did not.
Q. Do you have any reports on their operations?
A. Yes; twice daily.
Q. Did you at that time?
A. Yes, sir.
Q. What did that report show, if anything?
A. That they were pulling their pools down and after a shut off of the turbines it made a cut in the river which continued on out.
Q. State, generally speaking, the number of complaints you have had from pool #8?
A. Well, I would say we would have as many as eight or ten a month from that one point.
Q. How about pool #7?
A. About the same.
Q. And when you got these complaints did you go to them, and what was your job when you got there?
A. If the boats were grounded, get water from some of the other pools, if no vessels moving in any of the other pools we would take water out of the pools above and bring it down into the pool where the boats were grounded and float the boats.

By Mr. THOMPSON:

Q. Can your Honor hear the witness?

By the COURT:

A. By straining I can.

By Mr. THOMPSON:

Q. Can't you throw your voice a little stronger? Have you ever borrowed any water from #6 pool to help out on these other pools?
A. Yes, sir.

Q. And when you do that, what is necessary, if anything?
A. Notify all interests in #6 pool that we intend to take from 3/10 to 4/10 feet of water out. If any traffic moving we do not do
2729 that, but notify all landings and all boats moving that are in the pool that can tie up or not be stranded—we notify everybody in the pool.
Q. Why do you notify them?
A. To keep them from grounding their boats in their landings or while under-way.
Q. If you take 3/10 of a foot from the #6 pool and give it to #8, will that cause groundings?
A. Yes, sir.
Q. Is that when boats are tied up?
A. Yes, sir.
Q. As well as moving?
A. Yes, sir.
Q. Have you made any investigation in pool #6 because of complaints?
A. Yes, sir.
Q. Approximately, how many have you made there?
A. You mean altogether or any particular time?
Q. Altogether, since the Marmet was completed?
A. I would say fifty or more.
Q. And you were personally on the ground?
A. Yes, sir.
Q. And went to them?
A. Yes, sir.
Q. And you helped them to get off?
A. Yes, sir.
Q. How did you help them get off on #6?
A. Well, we would either get a little bit of water from the London pool or we would build up #6 pool to a danger point.
Q. When you found these groundings, did you consult your daily report for the Marmet and London stations?
A. I always knew it, knowing this would happen, what it would be. Of course, I would know all the gages at the time,
2730 know the amount of water in the river, and what they were doing above and below, everywhere from Hinton down. We know how much water there is from Hinton to anywhere in the river.
Q. How much do operators on the Kanawha River allow for tying up or sparing out?
A. They try for a foot.
Q. A foot of what?
A. Water, under their boats, quite a few places they can't get that.

Q. Do you know of any groundings in the Kanawha River in time of low water during the past year—in the Marmet pool?

A. Yes, sir.

Q. Have you attended investigations there?

A. Yes, sir.

Q. What have been the conditions?

A. Well, at the stage of normal pool at the dam, at a lot of their landings it is just what shows on the gage, that is, no more in their landing than what shows on the gage, at normal pool.

Q. I don't believe I understand that.

A. At the head of the pools—on the landings it is not a nine foot stage you understand. Well, any fluctuation, 3/10 or 4/10 gets them in trouble at some of their landings, not all, but the majority, they have barely enough to load their barges out.

Q. You said a reduction of 3/10 or 4/10 in the Marmet pool causes groundings at some of the landings?

A. Yes, sir.

Q. Was that 3/10 or 4/10 of a foot?

A. Yes, sir.

Q. Supposing there is a fog over the Marmet pool, what do the boats do, if you know?

A. Tie up immediately, if they can.

2731 Q. And where do they tie up?

A. Any place they can get to shore.

Q. And if there is a fall of the water of 5/10 of a foot, what, if anything, happens?

A. A lot of places they go aground.

Q. Would they go aground if it was 3/10 of a foot?

A. Some places; yes, sir. It all depends where they are caught in the fog.

Q. What is the condition of pool #6 with respect to groundings, that is, what drop in the normal elevation of that pool will cause groundings?

A. 5/10 of a foot.

Q. Have you had groundings at 5/10 of a foot?

A. Yes, sir.

Q. Where?

A. The harbor at Charleston and the harbor at Elk River and the coal companies.

Q. What do you mean by coal companies?

A. At their landings.

2732 Q. How many tipples of coal companies are there [interrupted].

By Mr. JACKSON. I object to all this testimony and move to strike it out. I don't know what testimony they are rebutting.

By the COURT. What do you say as to that Mr. Thompson?

By Mr. THOMPSON. Mr. Scheidenhelm has testified and I think Mr. Thomas or Mr. Putnam rather, that on a certain drop there would be no danger of interference with navigation in these various pools we are now discussing. I will read to your Honor from page 5274 the testimony of Rufus W. Putnam:

"Q. Major Putnam, in your opinion what, if any, adverse effect on navigation would result from an increase in stage at the head of the Marmet pool, at a rate not exceeding 1½ ft. per hour?"

"A. There would be no adverse effect upon navigation if the rate of increase in stage did not exceed 1½ ft. per hour up to a point where a critical discharge of 22,000 second-feet or more obtained, at which point it is possible current velocities would be such as to begin to interfere with navigation."

By the COURT. That is on the increase.

By Mr. THOMPSON. Yes, sir. Now on page 5277: "Q. Major Putnam, in your opinion, what if any, effect upon navigation in the Marmet pool would result from a decrease in stage at the head of the Marmet pool for not more than two hours at a rate not exceeding 1½ ft. per hour, or from a decrease in discharge at the head of the Marmet pool for not more than two hours, at a rate not exceeding 6,000 second-feet per hour?"

"A. The rate of change in stage would have no effect on navigation, adverse or otherwise, except the necessary adjustments to lines and spars where boats are tied up at the terminals, so long as this rate did not continue to a point where the
2733 pool was no longer maintained at its project level."

He is testifying as to the effect in these pools with only a drawdown of 5/10 of a foot, going away down below.

By the COURT. Below the project level, I presume?

By Mr. THOMPSON. He has not said that.

By the COURT. You don't expect me to believe this witness when he says no matter how deep the water is in the London pool and it goes down ½ foot it will ground boats when (interrupted).

By Mr. THOMPSON. We are not speaking about the London pool. We are speaking about the Marmet pool and #6.

By the COURT. What is project level?

By the WITNESS. Eighteen feet at the dam.

Q. And what is it at the upper end of the pool?

A. Nine feet.

By the COURT. If you keep it eighteen feet at the dam, no less than that, do you have any groundings?

By the WITNESS. Yes, sir, at their landings.

By the COURT. It seems to me you have a situation that can't be helped, you have not got enough depth in your pool.

By Mr. THOMPSON. It is due to fluctuation.

2734 By Mr. JACKSON. The fact is landings and harbors are no part of a Government project. Private individuals make their own landings and sometimes they try to save too much money, but that hasn't anything to do with Federal navigation or this suit.

By the COURT. Do you mean to say it is the duty of the lock masters there to keep that water eighteen feet deep at the Marmet dam?

By the WITNESS. Yes, sir.

By the COURT. Even when he does that he has groundings at some of the landings?

By the WITNESS. In fluctuations at eighteen feet he wouldn't have.

By the COURT. You said he would have a minute ago.

By the WITNESS. If he had eighteen feet he would have a nine foot project in the channel—any fluctuation from that will decrease the channel depth. In the landing, you understand what that is, there isn't nine feet always, and consequently any fluctuation of ½ foot will cause trouble in the harbor.

By the COURT. You mean a decrease?

By the WITNESS. Yes, sir.

By the COURT. Now the witness you quoted, whom you say you are seeking to rebut, makes it a condition the water shall not be lowered below the project level, doesn't he?

By Mr. THOMPSON. He says the rate of decrease will not affect navigation.

2735 By the COURT. Provided the water does not fall below the project level?

By Mr. THOMPSON. "The rate of decrease in stage at the head of the Marmet pool for not more than two hours at a rate not exceeding 6,000 second-feet per hour." The answer was: "The rate of change in stage would have no effect on navigation, adverse or otherwise, except the necessary adjustments to lines and spars at the terminals so long as this rate did not continue to a point where the pool was no longer maintained at its project level."

Are people going to have to elevate and change their spars all because of this power operation?

By the COURT. That is not what you are asking. You were asking about grounding vessels. You say his testimony is in contradiction of the witness you quoted.

By Mr. THOMPSON. I certainly do.

By the COURT. I have not been able to see it.

2736 Q. Is it possible to have a rate of change of 1½ feet per hour in the Marmet pool without affecting navigation?

By Mr. JACKSON. A rate of change of what?

By Mr. THOMPSON. A rate of change of 1½ feet per hour without affecting navigation.

By Mr. JACKSON. I object to the competency of the witness to answer that.

By the COURT. He may answer.

A. Yes, sir.

Q. What would happen?

A. Well, at that rate all kinds of boats would go aground.

By the COURT. Just a minute—there is one condition—that you should not go below the project level.

Q. Can you keep from going below the project level if you have a flow of 1½ feet per hour of fluctuation?

By Mr. JACKSON. I object to the question because not intelligible. You mean an increase or what?

By Mr. THOMPSON. An increase. I am asking the question you asked.

By Mr. JACKSON. I should think you would keep them from grounding unless you were loading very rapidly.

Q. Does the rate of change have any effect on navigation in the pool?

A. Yes, sir.

Q. Does the rate of change in stage have any effect on navigation in the Marmet pool?

A. Yes, sir.

Q. In what way does it have?

A. You could not navigate with a river rising one foot an hour.

Q. What would be the effect say with the river dropping 1½ feet per hour?

By the COURT. I would like to have the reason for that.

A. The current would be too strong in any river rising one foot an hour. The boat could not handle the tows.

By the COURT:

Q. Do you mean even when the water wasn't going over the top of the dam?

A. A river rising one foot an hour, the dam would be lowered, that is, the wicket dams so far as that would go, and the roller type dams would be raised. A river rising one foot an hour is very, very dangerous to navigation, or to the structures, that is, the dam.

Q. Have you ever known the river to rise in normal times in the Marmet pool at the rate of one foot per hour?

A. You mean with low water or high water?

2737 Q. High Water.

A. Yes, sir.

Q. How about low water?

A. I don't remember of it being one foot an hour in low water.

Q. What do you have to do when it starts to rise at that rate?

A. Immediately raise rollers, and lower the chanoine dams, put them all down.

Q. How close to the elevation do you keep the water in the pool at the Marmet dam?

A. About 1/10 of normal, that is, the dam at eighteen feet stage.

Q. 1/10 of a foot?

A. Yes, sir.

Q. And supposing it gets more than 1/10 of a foot below, what do you do?

A. We operate the dam to bring it to that point.

Q. Are you under orders to do that?

A. Yes, sir.

Q. And if it goes above 1/10, what do you do?

A. We operate the dam to control it.

Q. At what rate does the river flow up where it comes into the London pool, what speed does it have, what velocity would you say, approximately?

A. Oh, in open river I would say it would be probably three to four miles an hour.

Q. Assume a wave five inches in elevation, flowing with a river that is going 3 miles an hour, would you, from the banks be able to observe that?

A. Yes, sir.

Q. If it rose five inches in three hours, would you be able to observe it?

A. Yes, sir.

2738 Q. How about it if you were on a boat, could you observe it?

A. You could observe it there quicker than if you were on the shore.

By Mr. THOMPSON:

Q. What effect, if any, would that wave coming into the London Pool at the upper end, on a flow of 3 miles per hour, and the wave 7/10 of a foot high, have on navigation?

By Mr. JACKSON. I object to the competency of the witness to answer that.

By the COURT. Navigation where?

By Mr. THOMPSON. Within the London pool.

By the COURT. I will let him answer it.

By Mr. JACKSON. He has proven no qualifications, I submit, and I except.

A. It would cause a readjustment of landing places that were tied up in the landing and it would cause trouble to boats with tows operating either way, either up or down the river.

Q. And what would that be due to?

A. Current.

Q. What is the most serious problem with respect to stream flow that boats have up and down that river?

A. The fluctuation of it and current.

Q. And what do those fluctuations cause, if anything?

A. If they are serious enough, they cause boats to go ashore that are under way and those that are tied up—continual care must be taken of them.

Q. I ask you to assume this same wave passing on down from the London to the Marmet pool, what would be the situation in the Marmet pool with respect to being able to observe the wave from the shore?

By Mr. JACKSON. I object to the competency of the witness to answer the question.

By the COURT. He may answer it.

By Mr. JACKSON. Exception.

A. It would be the same.

Q. Would you be able to see it?

A. Surely.

Q. Would you be able to see it if you were on the boat?

A. Certainly.

Q. And would a boatman on there realize that there was such a wave if he were going up against it?

A. Sure.

Q. If it passed on down from Marmet to No. 6, what would the condition be?

A. It would be the same thing.

2739 Q. Assume a wave such as I have described, passing on from the Marmet to No. 6, state whether or not that wave would pass on down beyond No. 6?

A. Yes, sir.

Q. And how far down would it go?

By Mr. JACKSON. I object to the competency of this witness to testify to the behavior of waves. He hasn't shown the slightest qualification either in education or experience.

By the COURT:

Q. How were you going to get these waves past the different dams?

A. Water goes on by them and you have to take care of it somewhere.

Q. Mr. Thompson asked you about a wave coming down 7/10 of a foot high into the London pool and you told him what it would do and you say if that wave went on into the Marmet it would do the same thing and if it went on down below Marmet it would act the same way. How are you going to get it by these different dams?

A. You have got to pass that water. It don't make any difference where it goes to, and it creates the same thing, on and on.

Q. Suppose Marmet was drawn down, or London—which is the one of those dams that has a draw-down of 3 feet? Suppose that wave came into London dam when it was drawn down 3 feet. Would it go on through?

A. No, sir; not when it was down three feet.

By Mr. THOMPSON:

Q. But you are assuming the London dam is filled up?

A. I am talking about normal pool.

Q. And you are assuming it without a draw-down?

A. Yes, sir.

Q. How far down the river would that wave go?

By Mr. JACKSON. I object again to the competency of the witness to answer the question.

By Mr. THOMPSON:

Q. Would it go to the Ohio?

By the COURT. I will let him answer.

By Mr. JACKSON. Let our exception be noted and I also suggest that while I haven't been objecting counsel ought not to make every question leading.

A. Water would go on out of the Kanawha River if everything is normal, that amount of water.

By Mr. THOMPSON:

Q. Assume the construction of the Winfield dam—have you studied the situation of that river from the Marmet to the Winfield dam?

A. Yes, sir.

2740 Q. What is the shape of the river?

A. Very tortuous.

Q. Is it wide or narrow?

A. It is about 500 feet wide over all.

Q. And what is the channel width?

A. That will average about 100 feet. It is constricted at places to 60 or 80 feet.

By Mr. THOMPSON:

Q. State whether or not there are any waves coming from the Marmet dam that do affect navigation in Pool #6?

A. Yes, sir.

By Mr. JACKSON. I object to that question. It is not a proper question, not proper rebuttal.

By the COURT. I will let him answer it.

By Mr. THOMPSON:

Q. You say yes?

A. Yes, sir.

Q. What is the character of the channel from Marmet down to the Winfield dam site?

A. In quite a few places it is very narrow and the river is very crooked.

Q. Do you know a place called Elk Chute?

A. Yes, sir.

Q. Do you ever have any groundings on Elk Chute?

A. Yes, sir.

By Mr. JACKSON. I object to the testimony about groundings as not proper rebuttal and move to strike it out.

By the COURT. Objection overruled.

By Mr. JACKSON. Many our exception be noted?

By Mr. THOMPSON:

Q. What were those groundings caused by?

By Mr. JACKSON. If the Court is going to permit that, may I have a standing objection as to groundings as not proper rebuttal?

By the COURT. Yes.

A. By the fluctuations of the pool.

By Mr. THOMPSON:

Q. From what fluctuations?

A. Most of them from the power dams—from the power waves.

Q. Will the depth of the pools that will be produced by the construction of the Winfield dam obviate those groundings that you speak of?

A. Quite a few of them; yes, sir.

By Mr. THOMPSON:

Q. What is it that causes the grounding of boats in the channel, generally speaking, if you know, in a narrow channel?

2741 A. By the fluctuation or the dropping of the water while navigating them. When the water falls in these narrow channels it restricts them. Even if you have the project depth right in the channel, if boats handle these tows four or five hundred feet long out in front of them, the boat itself uses the water
2742 on either side of the channel. Probably the boat will be drawing 5 feet of water. It will get in position in this shallower water to drive these tows through the channel.

Q. Why it is that the boat itself can't keep its tows in the channel?

A. When it is going around a bend they have got to flank.

Q. Got to what?

A. Flank.

Q. What do you mean by that?

A. Back their sterns into a position that the head of the tows will be in line with the channel, probably have to drive out of this point and flank to the opposite side while the tow boat itself wouldn't always be in the maintained channel. It will be on one or the other side of it.

Q. What compels it to do that, if you know?

A. Tortuous channel. The channel is crooked.

Q. Is the channel tortuous from Marmet down to Winfield?

A. Yes, sir.

Q. And will the current, or, if there is a discharge from the Marmet power plant after the Winfield project is finished, be eliminated from the waves from the Marmet?

By Mr. JACKSON. I object to that question.

By the COURT. He may answer it.

A. The current will not all be eliminated. It will be reduced, but not all of it.

By the COURT:

Q. Mr. Carpenter, do you state that you undertake to keep the water in the pool at 18 feet at the dam?

A. Yes, sir.

Q. How far below the top of the dam is that?

A. That is right at the top of the dam, at the crest.

By Mr. THOMPSON:

Q. At the crest, you say?

A. Yes, 18 feet is the crest.

2743 Q. And do you try to keep it, as counsel here has described it so graphically, mathematically near that point?

A. Just under the top, so it won't roll over. We are not permitted to have water go over the roller type dam, over the top of it.

Q. And you have orders to that effect, do you not?

A. Yes, sir.

Q. State whether or not your orders are to hold it not less than one-tenth from the crest of the dam?

By Mr. JACKSON:

Q. Are your orders in writing?

A. Yes, sir.

By Mr. JACKSON. I object to the question as not the best evidence. If there are any orders in writing, the Government must have control of them.

By Mr. THOMPSON. A man can state, if he knows of his own knowledge. Certainly if he has orders, he doesn't have to bring a writing up here.

By the COURT. They may be in such language as to permit of some condition or exception or qualification. I will permit him to answer it, however.

By Mr. JACKSON. Exception noted.

By Mr. THOMPSON:

Q. What are your orders with respect to the height at which you shall keep this water in the reservoir at the Marmet pool?

Q. (The question was read as follows:) State whether or not your orders are to hold it not less than one-tenth from the crest of the dam?

A. Yes, sir.

Q. By that I mean one-tenth of a foot?

A. Yes.

Q. State whether or not that means that you are expected to hold it at one-tenth of a foot from the crest of the dam?

A. Yes, sir, we are.

Q. I think that you testified, did you not, that boats tried to allow for one foot when they are sparred out?

A. That is right.

Q. Are there any places along the channel, let us say in the Marmet pool, where there is less than one foot?

A. We have one.

Q. Where is that?

A. At Houston.

By Mr. JACKSON:

Q. You mean less than one-foot depth?

A. One-foot depth.

2744 By Mr. THOMPSON:

Q. What is the margin there, do you know?

A. Well, it is less than a foot. When that pool is down, when the storage is out of it, taken out of the pool, we have less than a foot—around a foot at the London pool.

Q. That is under the bottom of the boat?

A. Yes, when that pool is down.

Q. Were you informed at the time of these groundings that you speak of in the #6 pool as to the power plants operations occurring at the time of the groundings?

A. Yes, sir.

Q. How would that occur? Who, by the way, is the Lock Master at #6?

A. Mr. Bright.

Q. And if there is a grounding, does he call you?
A. Immediately.

By Mr. THOMPSON:

Q. What would be the effect on the wicket dams of a wave of 7/10 of a foot, passing on down the river?

By Mr. JACKSON. I object to the competency of the witness to testify at all as to waves, and may our exception be allowed generally to that line of testimony.

By the COURT. Yes.

A. The wickets would have to be operated to pass the flow of water on.

By Mr. THOMPSON:

Q. What do you mean, by raising the wickets or lowering them?
A. Lowering them down to give space for water to pass by, simply putting them down.
Q. Do you have any experience with waves going down that river where the wicket dams are?
A. Yes, sir.
Q. What experience have you had?
A. I have to be in charge of the operation of the dam, be out with them.
Q. Are you there when they raise and lower the wickets?
A. Not always.
Q. Frequently or infrequently.
2745 A. Well, I would say infrequently, unless something happens unusual. The Lock Master is competent to operate the wickets unless something unusual happens, and I don't have to go to them.

By Mr. THOMPSON:

Q. Based on your experience in operating locks and dams on the Kanawha and Ohio Rivers, what is your opinion as to whether or not power waves received into the London pool under the conditions under which the Marmet pool is now operated, would be transmitted through the Marmet, Winfield, and Gallipolis pools into the Ohio River?

By Mr. JACKSON. I object to the competency of the witness to answer that.

By the COURT. What power waves has he ever seen transmitted into the London pool?

By Mr. THOMPSON:

Q. Have you ever seen power waves coming from the London pool into the Marmet pool?

By the COURT. I understood you to say coming into the London pool.

By Mr. THOMPSON:

Q. Based on your experience in operating locks and dams on the Kanawha and Ohio Rivers, what is your opinion as to whether or not power waves received into the Marmet pool under the condition under which the Marmet pool is now operated, would be transmitted through the Marmet, Winfield, and Gallipolis pools into the Ohio River?

By Mr. JACKSON. I object to the competency of the witness to answer that question. It is a question that involves a higher degree of knowledge of hydraulics than this witness has.

By the COURT. I think so, but if this witness thinks he has the knowledge, he can answer it. It is based on his experience and observation.

By Mr. THOMPSON. Here is a man that is doing nothing else but going up and down this river, called out practically day after day and many nights to test waves that are coming from the Marmet pool and yet counsel has the audacity to arise and object to his being an expert after they put on this gentleman that came from up near Pittsburgh.

By the COURT. He may answer.

By Mr. JACKSON. May our exception be noted?

A. My opinion is that the water would go on out into the Ohio River at about the same rate that it was received into the Marmet pool.

Q. Mr. Carpenter, assuming a total rise in stage in the Marmet pool of 9/10 of a foot in five hours, with a similar decrease in stage, and this rise and fall occurring every 24 hours during the week, what would be the effect on navigation moving up-stream?

By Mr. JACKSON. I object to the competency of the witness to answer that question.

By the COURT. He may answer it.

A. At the peak of the rise, moving up-stream, it would be difficult for towboats to handle their tows.

By Mr. THOMPSON:

Q. What do you mean by "difficult"?

A. Currents driving them on shore from some of the chutes that they go through.

Q. And what would the situation be as to those moving down-stream?

A. It would be practically the same thing.

Q. Assuming a total rise in stage below the Marmet pool of 1.2 feet in five hours with a similar decrease in stage, and this rise and fall occurring every 24 hours during the week, what would be the effect on navigation in pool #6 that was going up-stream?

A. It would be the same effect and besides it would have everybody crazy most of the time, keeping their stuff afloat, keeping their boats afloat in the landings.

2746 Q. Would that condition exist both going upstream and downstream?

A. And in the landing, yes.

Q. How often do these power waves go down the river, if you know, from the Marmet dam site?

A. Each time they operate their power plant.

Q. And what is the result among the shipping industry on the river?

By Mr. JACKSON. I object to that question as entirely too indefinite.

By Mr. THOMPSON:

Q. What is the effect, if you know?

By Mr. JACKSON. I object just the same as too indefinite.

By the COURT. He may answer.

By Mr. JACKSON. Exception noted.

A. It keeps them in a state of uncertainty as to the mooring of their vessels in the harbor and a navigator leaves one lock with the assumption that there will be no change in the river and he meets this and he is all bewildered. He simply doesn't know exactly what to do and it causes considerable trouble wherever he meets this wave.

2747 Cross examination by Mr. JACKSON:

Q. Mr. Carpenter, how old are you?

A. 58.

Q. You started working for the Government in 1905?

A. Yes, sir.

Q. And where did you work before that?

A. Before I started work for the Government?

A. Yes.

A. I worked in a timber camp at various places.

Q. As I understand it, up to the time you went with the Government you had been working in timber, lumbering, and things of that character?

A. And river work.

Q. Mr. Carpenter, will you define a wave for me.

A. As I see it, it is a sudden rise of water in pools that passes rapidly along the river.

Q. You say it is a sudden rise; is that right?

A. Yes.

Q. Will you tell me how great a rise and how sudden it is? to constitute a wave in your definition?

A. Well, speaking on the river that I have had anything to do with, a wave from half a foot on up.

Q. You mean if you could see the face of water half a foot high or higher?

A. No, I don't mean that.

Q. What do you mean?

A. I mean a rise of that.

Q. And how sudden?

A. From one to five or six hours for half a foot.

2748 Q. That is, a rise of half a foot in one to five or six hours, is a wave, according to your definition?

A. Yes, sir; that is the way we look at it.

Q. Did you discuss waves with anyone before you came here to testify?

A. Before I ever knew there was a trial here, I did.

Q. With whom?

A. With employees and with my superiors.

Q. How long ago was that?

A. That was when we contemplated the operation of those—wondered what we would do, how the power plants would act at the Marmet and London pools.

Q. That was about the time that the power plant at the Government navigation dam was going to commence operation?

A. Before that.

Q. Just before that, and that was the first time you discussed waves with your superiors, wasn't it?

A. Yes.

Q. Did they tell you what the shape of a wave at that time was?

A. No; he had graphs he showed me.

Q. He showed you some graphs?

A. Yes.

Q. What graphs did they show you? Have you got them with you?

A. No; not any particular kind. We had them in the office and looked at them and they showed the effect.

Q. You have defined a wave in general. Tell me what would be the slope of the front of the wave that you have in mind?

A. I wouldn't know that.

Q. Have you any idea?

A. I would know where a certain body of water would start and know what to do with it from one dam to another.

Q. I am trying to find out how steep this wave is.

2749 A. I have no idea.

Q. Could you tell me whether it would be one degree or sixty degrees from the horizontal?

A. I couldn't tell you that.

Q. You don't know about that. Well, now, Mr. Carpenter, assuming that you were standing on the bank on the side of the London pool and there were a rise of five inches taking place gradually over a period of 5½ hours, is it your testimony that standing there on the bank you could observe the rising water?

A. Yes, sir.

Q. That is, you mean that as you stand there, you can look out and say, "I see the water rising"; is that right?

A. I would say "the river is rising."

Q. You could see that?

A. Yes.

Q. That would be a total rise of less than an inch in an hour, wouldn't it?

A. Five inches in five hours.

Q. Five inches in 5½ or 6 hours? It would be something less than an inch an hour?

A. That is right.

Q. And can you tell me how much of a rise that would be in one minute?

A. No; I wouldn't attempt to. I wouldn't know. I just would know that the river is rising.

Q. You can check me on the mathematics; I take it that if that water were rising at the rate of something less than an inch an hour, it would be rising at the rate of something less than 1/60 of an inch a minute, wouldn't it?

A. Well, assuming that it did.

Q. I just wanted to see how fine your eye is. It is your testimony that you can stand along the side of a river and you can observe with your naked eye a rise as small as something less than 1/60 of an inch a minute.

2750 A. Particularly when the river is rising.

Q. Answer my question directly. Can you observe a rise as small as that?

A. Yes, I can tell.

Q. You can tell?

A. I can tell.

Q. In the same way you can stand on the bank of a river and if the river is falling at a rate of less than 1/60 of an inch a minute, you can observe that, can you?

A. A falling river is harder to determine than a rising river.

Q. Now, let us see; do you think, standing on the bank of a river, you could observe with your naked eye a fall in the surface of the river at a rate of less than 1/60 of an inch a minute?

A. I could not on a falling river.

Q. Suppose instead of taking five or six hours to fall 5 inches, it took 18 or 20 hours, do you think that you could observe a falling in the river stage as you stood along the bank?

A. No, sir.

Q. Do you think that if you were on a boat you could observe the fall in the river stage declining at the rate of five inches over a period of 18 or 20 hours?

A. No, sir.

Q. You couldn't detect that in a row-boat, could you?

A. No, sir.

Q. I wanted to see whether you want to reconsider your testimony about a rise. In your opinion, would a rise in the stage of the river, proceeding at the rate of something less than 1/60 of an inch a minute, or less than one inch in an hour, have any effect on a boat?

2751 A. Sure, it would have an effect on the boat.

Q. Would it have a pretty substantial effect, in your opinion?

A. It all depends on where the boat was at the time.

Q. You are moving now on the surface of the stream?

A. That is right.

Q. Is it your testimony that a rise in stage at the rate of something less than 1/60 of an inch a minute or less than an inch in an hour would have any substantial or appreciable effect upon the boat?

A. Yes, sir.

Q. That is your testimony?

A. Yes, sir.

Q. You are very clear about that?

A. Yes, sir.

Q. I want to show you a statement in defendant's exhibit 544 for identification, which is a document compiled in the Huntington Engineering Office, as to certain wave tests in 1930 which had an amplitude in excess of what I have stated to you, and I read to you from page 113 as follows: "The tests (referring to these waves)——"

By Mr. JACKSON:

Q. Mr. Carpenter, I read to you from page 113 of this compilation of the Engineer Office at Huntington as follows: "The tests (referring to these 1930 wave tests) perhaps were important in demonstrating the absence of any marked changes in stream stages such as would affect transportation vessels as they were too slight to even affect a row boat," and ask you whether or not you agree with this conclusion that I have read to you from this document?

A. I can't agree to that.

Q. You didn't take any part in those wave tests in 1930, you?

A. No, sir.

Q. Did you know Major Herman?

A. Very well.

Q. Was he District Engineer in charge of the Huntingt District in 1930 and some time thereafter?

A. I think so, yes.

Q. And if that conclusion that I have read to you were su scribed to by Major Herman, would that affect your judgmen

By Mr. THOMPSON. If the Court please, I object to that. isn't shown that this document ever was subscribed to by Ma Herman. This document is not in evidence. As I understa it, it was ruled out. He is asking him if it has been subscrib to and that it came from the Huntington office. I suggest th is misleading to the witness.

By the COURT. I think the objection is well taken unless the is some showing that the opinions there expressed were tho of Major Herman.

By Mr. JACKSON. I have nothing but the two letters of tran mittal.

By Mr. JACKSON:

2752 Q. Mr. Carpenter, you have been testifying about cu rents in some of these future pools: What would be t velocity of current in the Gallipolis pool, when completed, with flow of 2,000 second feet?

A. Put that into "opening into the dam" and I could tell yo about that. I don't know anything about second feet to curren Put it into "opening into dam."

Q. Is current expressed in second feet?

A. Not in my language; I know it is, though.

Q. Well, you would not have any idea what velocity woul result from a flow of 2,000 or 3,000 or 4,000 second feet through th future Gallipolis pool?

A. No, sir; you would have to give me the opening in the dam- the way we get our currents. I don't go by miles or cubic feet o second feet.

Q. You testified about some waves passing down through Ma met, the future Winfield pool and the future Gallipolis pool an into the Ohio River. Let me ask you this question: Assumin a wave with a total amplitude or volume of 4,000 second feet enter ing the London pool and riding on a base flow of 2,000 second fee how much would that wave raise the Gallipolic pool by the tim it reached the Gallipolis dam?

A. We would not permit it to raise any.

Q. I did not ask you that.

A. I could not tell you that. However, we would not allow for our pools to raise above normal.

Q. I did not ask you that. I will ask that the question be read.

By Mr. THOMPSON. He is doing very nicely; let him answer your question. Let him proceed.

By Mr. JACKSON. Q. I will ask for the question to be read. [The question is read.]

By Mr. THOMPSON. I would like to suggest that this witness does not understand the term "amplitude." Counsel should state that in the English language.

By Mr. JACKSON. I told him what it was—volume; and he was offered as an expert. I did not think he was an expert, however.

By Mr. THOMPSON. He is an expert on the operation of the dam, but not on "amplitude."

By the COURT. That is the very line of examination that you conducted, Mr. Thompson. You asked him to define or as to the manner these waves passed from one dam into another. You may not have expressed it in second feet. You probably said waves of such a height in inches.

By Mr. THOMPSON. Yes, sir; in the simplest language. If you talk about "amplitude", you will have to throw the life-line out for him.

By the COURT. If he does not understand it, he may say so.

By Mr. JACKSON. The questions that you asked (addressing opposing counsel) were so general, I could answer them myself and would not have to cross-examine this witness. Please read the question. [The question is read.]

A. I could not tell you that.

Q. What is the area of the Gallipolis pool?

A. I don't know that either.

Q. How many acre-feet of water would it take to raise the Gallipolis pool one half inch?

2753 A. I don't know.

Q. What is the area of the Winfield pool?

A. I don't know.

Q. Can you tell me how much water it would take to raise the future Winfield pool—how many acre-feet or second feet—an inch?

A. No, sir.

Q. Assuming that the Marmet pool varied 0.3 of a foot, how much would it raise the surface of the future Winfield pool?

A. 0.3 of a foot?

Q. Yes, sir.

A. Probably 0.1 or 0.2.

Q. Why do you say that?

A. I never had experience with Winfield pool being in operation. It is not completed.

Q. Do you know how much volume of water would be involved for lowering the Marmet pool 0.3 of a foot?

A. In second feet, no, sir.

Q. Or in acre feet?

A. No, sir.

Q. Or in any other unit of measurement?

A. In tenths only; in tenths of a foot at a given point.

Q. How many tenths of a foot would it be?

A. Probably one or two.

Q. If you change it 0.3 of a foot at Marmet, would it be 0.1 or 0.2, say, in Winfield?

A. I could not say definitely.

Q. You do not have any idea how much volume of water it would take to effect a change of 0.1 or 0.2 or 0.3 of a foot in the Winfield pool?

A. It don't have any pool as yet.

Q. Or the future pool. You have testified about that, Mr. Carpenter?

2754 A. No, I could not tell you how much water 0.3 of a foot would make in Marmet pool or Winfield pool, for the simple reason that I have had no experience with Winfield.

Q. Can you tell me how much volume of water it would take to raise No. 6 pool, one inch?

A. Tell you how much it would take?

Q. Yes, sir, how much volume?

A. (No answer from witness.)

Q. You cannot tell how much volume of water it would take to raise any pool now in existence on the Kanawha River one inch, two inches, or three inches?

A. Expressed in second-feet?

Q. Acre-feet, gallons, or anything else?

A. No, not in acre-feet.

Q. I don't care whether it is acre-feet; it can be gallons or second-feet or any unit of measurement of volume that you know of. Can you?

A. No, sir; I cannot tell you.

Q. Can you tell me what velocity of flow would result in any pool on the Kanawha River, by reason of a flow of 1,000 or 2,000 second-feet?

A. You mean by current?

Q. Yes, sir.

A. Very little; it would be very little; I don't know exactly.

Q. And you do not know what change in velocity of flow would be produced by increasing the flow through the pools from a base flow of 2,000 second-feet to a base flow of 4,000 second-feet?

A. Not exactly.

Q. Can you tell me approximately how much it would increase it?

A. No, sir; I would not want to make that expression; no, sir.

Q. You said you never let water go over the dams, didn't you?

A. The roller type dam.

2755 Q. Would you do anything in case of a flood?

A. We take them out of the river.

Q. You let the water go over the crest of the dams at times, do you?

A. Not unless there is some accident.

Q. You are drawing the distinction between going over the roller gates and over the crest of the dam?

A. Yes, sir.

Q. And when there is a flood into the dam, it flows over the gate and not the crest of the dam?

A. No; the crest of the dam is the top of the gates—is the top of the roller.

Q. It is your testimony that when the roller gates are down, water never goes over the crest of the dam?

A. It should not; it seldom does; it might rush over.

Q. I am not talking about what it should do. Is it your testimony that it does or does not go over the roller gates?

A. It has gone over at times, but it is against all our regulations and orders to do that.

Q. Regardless of the regulations and orders, it is a fact that, from time to time, water does flow over the top of the roller gates?

A. Occasionally.

Q. To what depth?

A. I don't know what depth.

Q. Do you operate these dams or not?

A. Yes, sir.

Q. But you are not close enough in contact with them to know what depth the water flows over at times?

A. No, sir; it don't last but a few minutes, unless you are talking about the roller flap.

Q. No, sir. Tell me at what depth the water does at times flow over the roller gates, if you know, and if you don't know tell me so?

2756 A. We have one roller goes over five feet. It is a flap gate.

Q. I am not talking about that.

A. I don't know how deep it was the—over the top—the time the surge came over. We have had water over the roller a few times.

Q. And you don't know how many or how much?

A. No, sir; I could not tell you.

Q. How far down below the top of the gates has the Marmet pool been?

A. The roller has been out of the water, all of them.

Q. The rollers have been out?

A. The roller gates at the crest of the dam. It is a roller dam and in high water, or when you spill the water out, it is picked out of the water and the water goes under the gates.

By the COURT. He didn't ask that.

By Mr. JACKSON:

Q. When the roller gates are closed and the other gate is up, is it your testimony that the water at Marmet has never been below the crest of the gates?

A. Surely, it has been below, yes, sir.

Q. How much?

A. It is kept at 0.1 below nearly all the time, to keep from going over.

Q. What drop below the crest of the roller goes in the operation of Marmet?

A. About 0.1; we have a variation of about 0.1.

Q. Are you sure of that?

A. Yes, sir; quite sure.

Q. What would you do if it went over 0.1 below?

A. We would find out the cause of it, with the exception of making a test or something, or something like that.

By the COURT:

Q. Doesn't it vary more than that when there is lockage?

2757 A. No, sir; no, sir. We have a very close margin to operate on.

By Mr. JACKSON:

Q. Do you operate the London roller gates every time Marmet gets more than 0.1 below, or as much as 0.1 below the crest?

A. If necessary, we would, yes, sir.

Q. Do you—I asked you if you do?

A. Yes, sir.

Q. Whenever it is 0.1 below, you operate the roller gates?

A. Yes, sir.

Q. Of London?

A. Not always; we used the power company since they have been in there.

Q. Do you operate the roller gates at London whenever Marmet drops 0.1 below the crest?

A. No, sir.

Q. That is, in order to get water from London to Marmet?

A. No, sir; you don't operate the roller gates for that.

Q. Why not?

A. We asked the Power Company to change their volume on the turbines.

Q. Now, who is your superior officer in charge of the Huntington District?

A. Mr. Cassell is immediate, and Colonel Conklin is the District Engineer.

Q. Well, let me ask you. You have testified—a variation of 0.8 of a foot, was it?

By Mr. THOMPSON:

A. It was 0.7.

By Mr. JACKSON:

Q. In Marmet—in a period which would rise in Marmet at the rate of 0.8 of a foot in 5 hours—that it would cause trouble to navigation in the Marmet pool?

A. Yes, sir.

Q. Would it do that in any other pool, if the change in stage was at the same rate?

2758 A. It would in any pools below there.

Q. How about London?

A. It would below their draw down.

Q. Why wouldn't it above the draw down?

A. You mean—it would not affect the landing in the London pool. They always prepare to keep their plant out when these draw downs are made.

Q. Will you define what you mean by a "rate of change in stage"?

A. A falling or rising river.

Q. Yes, but what do you mean by a "rate of change in stage"?

A. The speed which it takes to flow.

Q. You mean how rapidly the changes occurred over an hour for instance?

A. For any length of time, yes, sir.

Q. Well, if a rate of change of stage of 0.7, did you say?

By Mr. THOMPSON:

A. It was 0.8.

By Mr. JACKSON:

Q. (Continuing.)—of a foot an hour—no, five hours rather—strike that. That would be how much an hour—0.8 of a foot of change in five hours, would be how much in one hour?

A. It would be what?

Q. Strike that out. Assuming the rate of change to be 0.8 of a foot in five hours, how much would that be in one hour?

A. It would be .1, wouldn't it?

Q. 0.1 of a foot?

A. 1.3—I don't know.

Q. It would be 0.16 of a foot in one hour, would it not?

A. 0.5 in an hour.

Q. You testified that a rate of change of 0.8 of a foot in five hours, would be injurious to navigation. I am asking you to tell me what rate that would be in one hour. I get it 0.16 of a foot; is that right?

A. It would be 0.1 an hour—0.5 in 12 hours.

2759 Q. Eight you said?

A. In five.

Q. In five hours. I do not want to confuse you. Tell me what you compute the rate of change for one hour to be, on the assumption of a change of 0.8 of a foot in five hours?

A. (Witness is handed paper by counsel and figures.) It would be one and three-fifths, tenths.

Q. The same as 0.16, isn't it? Is that right? I am trying to agree on a figure, so that we may proceed.

A. I will agree with you.

Q. If, in your opinion, 0.16 of a foot an hour in the rate of change in stage in the Marmet pool, would have an adverse effect on navigation, what would you say as to the effect of a change of stage at the rate of one-half a foot an hour?

A. A half a foot an hour?

Q. Yes, sir.

A. The effect would be greater.

Q. That would be the same as a change of 2½ feet in five hours, wouldn't it?

A. Something like that.

Q. And you regard that as more dangerous?

A. Sure.

By Mr. JACKSON. Here is a paper which I desire to have marked for identification as Defendant's Exhibit No. 608.

(The foregoing paper was marked as indicated.)

Q. Are you familiar with the signature of Colonel Conklin?

A. Yes, sir.

Q. Did you ever see his signature?

A. Yes, sir.

Q. I show you a signature on Exhibit No. 608, marked for Identification for the defendant, and ask you if that is Colonel Conklin's signature. [Exhibits to witness.]

A. Yes, sir.

Q. I read to you from Colonel Conklin's letter, dated June 26th, 1936, addressed to the Kanawha Valley Power Company, and signed by Colonel Conklin, the following passage on page two.

2760 Q. I invite your attention to this. It is entitled "Subject: Kanawha River pool fluctuations resulting from operations of the London and Marmet hydro plants.

"Following some discussion, it was agreed to proceed as follows, with the understanding that the procedure is subject to such modifications as developments may necessitate.

"(a) The rate of draw down in the London pool will not exceed ½ foot an hour."

Q. (Continuing.) And I ask you whether or not this rule of operation by Major Conklin affects your judgment as to what, if any, effect would be produced on navigation by the decrease in stage in the Kanawha River pools at the new dams at the rate not to exceed ½ of a foot an hour?

A. Is that the London pool?

Q. Yes, sir. Would that affect your judgment?

A. Not a bit in the world.

Q. You think that that decrease in stage at that rate, in the London pool, would not have any adverse effect on navigation?

A. Below?

Q. No, in the London pool?

A. They can draw from the pool to 3 feet.

Q. Do you think that change in rate in stage, at the rate of ½ of a foot an hour on the London Pool, would have any adverse effect on navigation in that pool?

A. Yes, sir; I do.

Q. You disagree with this rule of operation, that the rate of draw down for the London Pool was not to exceed ½ a foot an hour?

A. That is right.

Q. I direct your attention to the next paragraph from this letter. [Reading.]

2761 "(b) The level of the Marmet Pool will be kept within the range of plus 0.0 and minus 0.3 and pool oscillation on the lower gage at London due to turbine operations, will not exceed the rate of ½ foot per hour.

Q. (Continuing.) Do you understand that that would permit drops or dips in the Marmet Pool to the extent of 0.3 of a foot—a decrease in stage in Marmet Pool not exceeding, at the rate not to exceed ½ of a foot an hour?

A. You mean at Marmet, at the rate of 0.3 of a change?

Q. Yes, sir.

Q. (Continuing.) That provides for a draw down of 0.3 below normal pool level in Marmet?

A. We haven't such orders.

Q. Doesn't this letter say that?

A. Yes, sir.

By Mr. JACKSON:

Q. Does the letter provide for a decrease of stage in the Marmet Pool at a rate not exceeding ½ of a foot an hour?

A. It certainly does. The letter says so.

Q. Do you agree with those methods of operation of the Marmet Pool outlined by Mr. Conklin in his letter, marked defendant's exhibit for identification No. 608, and which I have just read to you?

A. Do I agree with it?

Q. Yes, sir.

A. Not in toto, no, sir.

Q. To what extent do you agree with it?

A. I disagree with the London draw-down. He knows it himself—that I disagree with the draw down.

Q. A half a foot an hour?

A. Yes, sir; and my orders have never been changed.

Q. Does he know that you disagree with the minus 0.3?

A. I don't suppose so.

2762 Q. You had a disagreement with him about the half a foot an hour, did you?

A. I simply talked with him.

Q. Have you got the records of the actual operation of the gates of the Marmet Pool with you?

A. No, sir.

Q. Have any of your assistants in the Court Room those records with them?

A. I don't know whether they have or not.

Q. Will you find it, because, if so, I would like to see the records.

A. Just since February, he says. [Witness answers this question as result of information from a voice in Court Room.]

Q. Will you produce those since February?

A. They are at the hotel.

By Mr. JACKSON:

Q. Mr. Carpenter, I think you said Colonel Conklin is your superior officer in charge of the operations of the Huntington District?

A. Yes, sir.

Q. And he is the officer who gives the final orders as to what is done by you and everyone else in the district, is he?

A. Yes, sir.

Q. And he has under his jurisdiction the operation of the navigations works of the Ohio River in that district?

A. Yes, sir.

Q. And he also has jurisdiction over the operations of the power plant on the Government navigation dams at London and Marmet?

A. Yes, sir; I presume so. I don't know.

Q. You——

By Mr. THOMPSON:

Q. What was the answer?

A. I presume so.

2763 By Mr. JACKSON:

Q. You don't know that?

A. No, sir.

Q. You know, don't you, that these power stations on the navigation dams are operated under licenses from the Government, don't you?

A. Yes.

Q. And you know that the district engineer, Colonel Conklin, has supervision over that?

A. I am not so sure of that.

Q. You are not?

A. No, sir.

Q. You don't think that you have supervision instead of him, do you?

A. No, sir; I know I haven't.

Q. To the extent that any supervision that is exercised, you know that it is exercised by Col. Conklin, don't you?

A. If we get into trouble, we turn it over to the district office, and there our trouble ceases.

Q. You don't know anything about it from that time on?

A. I have nothing to do to correct it.

By Mr. THOMPSON:

Q. What?

A. From the time they get it from the office, we don't go into how they do.

By Mr. JACKSON:

Q. From the time they get what, you don't go into it?

A. If we get a complaint from the lock-master that something is going wrong, we immediately notify the Huntington office—usually Mr. Cassell.

Q. And then you are through with your part?

A. I have done all I can do.

Q. You report any groundings you know about to the Huntington office, don't you?

A. If they are serious.

2764 Q. If they amount to anything, you do?

A. Yes, I report them to my superior officer.

Q. And you have reported to Col. Conklin's office every grounding that has come to your attention since the Marmet plant started that you regarded as serious?

A. Every one that I regarded as serious.

Q. Now, when were the groundings generally that you were talking about on direct examination?

A. Do you mean the dates?

Q. Yes.

A. I don't remember.

Q. You have no date?

A. I did not keep any date of them; they were too numerous.

Q. Did you say there was trouble at one place in the Marmet pool, at Houston?

A. At Houston.

Q. How do you spell it?

A. H-o-u-s-t-o-n.

Q. Is that the full name of the place?

A. Yes, sir.

Q. What is it—a landing?

A. Yes, sir.

Q. Of a coal company?

A. That is right.

Q. And where is that located?

A. The landing is probably a mile or such a matter below Houston.

Q. How far is it below the London dam?

A. Probably two miles, or something like that—two or three miles.

Q. What kind of trouble develops there?

A. Grounding of barges.

2765 Q. Where—in the channel?

A. No; in the landing.

Q. Is that the same as a harbor?

A. The same.

Q. What is there? Just a place to tie up?

A. A coal tipple.

Q. Is that the place where the most trouble is?

A. Not particularly there. Wherever they tie up or have a landing.

Q. I thought you said that was the place where they had the most trouble?

A. That is the shallowest place.

Q. The trouble is that it is a pretty shallow landing, isn't it?

A. That is right.

Q. How long has that landing been there?

A. I don't know.

Q. That has been there a good many years, hasn't it?

A. Yes, sir.

Q. Was that landing in the old No. 3 pool?

A. Yes, sir.

Q. What is the elevation of the new Marmet pool with reference to the old elevation of the old No. 3 pool?

A. I don't just remember. [Witness looks at memorandum.]

By the COURT:

Q. Where is the old No. 3 dam—between Marmet and London?

A. Yes, sir.

By Mr. JACKSON:

Q. About how many miles below London is the old No. 3 dam, Mr. Carpenter?

A. Three miles and a fraction.

Q. Will you tell me what the elevation of the present Marmet pool is compared with the elevation of the old pool No. 3?

2766 A. The old No. 3 is 591.57 elevation, and Marmet is 590.0.

Q. Then the elevation of old No. 3 pool was 1.57 feet above the elevation of the present Marmet pool?

A. Yes, sir.

Q. When the present Marmet pool was constructed and the old No. 3 destroyed, the landing was lowered 1.57 feet, wasn't it?

A. Yes, sir.

Q. And do you think that had anything to do with the landing at Houston?

A. The landing could have filled up.

Q. What is that?

A. The landing could have filled up.

Q. Do you think the lowering of the elevation, when they took out old No. 3, had anything to do with it—the lowering of the pool?

A. I don't think so.

Q. You do not think that had any effect, do you?

A. No.

Q. It did, however, decrease the water 1.57 feet, didn't it?

A. It raised the water 1.57 feet.

By Mr. THOMPSON:

Q. It did what? Raised it or lowered it?

A. (Witness looks at memorandum.) There is a difference 1.57.

By Mr. JACKSON:

Q. Which way?

A. Raised.

Q. It raised it?

A. Yes, sir.

Q. Will you give me the elevation of Marmet pool?

A. 590.

Q. What is the elevation of pool 3?

A. 591.57.

Q. Is the elevation 591.57 lower than 590?

A. It is higher; 591 is higher than 590.

2767 Q. When you took out dam 8, did that lower the lev of the water above it, or not?

A. It lowered it.

Q. And it was lowered at one point 1.57 feet?

A. Yes.

Q. You do not think that had anything to do with the difficu ties at the landing at Houston?

A. It could have.

Q. You don't think it likely?

A. No.

Q. Then would you think the same thing would be true of an other landing, that the lowering of the water 1.57 feet woul not have any effect?

A. At any other landing?

Q. Yes.

A. Yes, surely.

Q. You think it would have an effect in another landing?

A. Yes.

Q. Now, Mr. Carpenter, the Government provides a throug channel down the Kanawha River, doesn't it?

A. It provides a channel.

Q. It dredges a channel down through the pools that is use by navigation going up and down the river?

A. That is right.

Q. The harbors or landings, as you call them, are provide by private interests that use them?

A. Yes, sir.

Q. And the depth of those harbors and landing depend o how deep the private interests choose to dredge the landing an the entrance to it?

A. It depends on the keeping of normal pools.

Q. Assuming that a pool is at normal level, does the depth of water at the landings and harbors depend upon the depth to which the private interests using those landings and harbors have dredged them?

2768 A. That is right.

Q. And that dredging is done by private interests at their own expense?

A. Most always.

Q. It is unless sometimes a city will provide, at its expense, a landing or harbor?

A. Yes.

Q. And the Federal Government has nothing to do with maintaining either one?

A. No.

Q. And do these landings, private and municipal, fill up with silt and coal dropping off barges?

A. Yes.

Q. And they tend to get shallower from time to time by reason of those phenomena, don't they?

A. That is right.

Q. And if the private interests and municipalities do not choose to dredge pretty soon, they will soon have trouble at these landings and harbors?

A. If they don't keep them cleaned out they will get shallower.

Q. And this does happen, doesn't it?

A. Yes, sir.

Q. Now, what causes groundings there at the power station operations?

A. Fog and current.

Q. Anything else?

A. Any fluctuation in the water, or any sudden drop of water, will cause it.

Q. Does it make any difference to what draft the vessel is loaded?

A. Oh, sure.

Q. If the vessel were loaded to nine feet, on an elavation of ten feet, and the water dropped anything less than a foot, there would not be a grounding, would there?

A. Yes.

2769 Q. If it dropped a half a foot, under those circumstances, there would be a grounding?

A. I thought you said a foot. As far as moving steamers, it is not enough.

Q. The fact is, of course, Mr. Carpenter, that questions of groundings are affected by the depth to which the barges are loaded?

A. Quite a bit.

Q. And when one is trying to flank around a channel, as you have been talking about, the operator sometimes does not maneuver perfectly and runs against the bank of the channel, doesn't he?

A. Occasionally that is the case.

Q. Now, as to any of these groundings that you testified about, do you know the draft to which these barges were loaded in any particular instance?

A. I do not recall them just right now.

Q. So you can't give me now any specific grounding, or the date, or the draft to which the barges were loaded?

A. I can't give the date.

Q. Is it any part of your business to find out about the drafts?

A. That is the lock-master's business to find out the drafts of the boats.

Q. When you investigated grounding did you investigate the draft to which the barges were loaded?

A. Sometimes. It is my business to get them out.

Q. Your principal job is to get the barge released and you don't pay much attention to what the draft might be?

A. I would pay attention to them sometimes.

Q. You simply report the circumstance of the grounding to your superior officer in the District Engineer office and from that time on you have nothing to do with it; is that right?

A. Not until they are afloat.

Q. After you have performed your duty in trying to get the tow or barge afloat you simply report the circumstances to the
2770 District Engineer office and you have nothing further to do with it?

A. After the barge is afloat.

Q. You make no further investigation of draft or other conditions that obtained at the time of the grounding?

A. I might, to know what the draft is at the time. I must know that.

By Mr. THOMPSON. What the draft is?

By the WITNESS. Yes, sir.

Q. You have testified about some of this grounding you thought was due to the operation of the Marmet plant. You didn't know that definitely, did you?

A. That was the cause of it. Yes, I knew that.

Q. You were very clear about that?

A. Yes, sir.

Q. You reported that to Col. Conklin?

A. I never report direct to him.

Q. Did you report to your immediate superior?

A. That is right.

Q. Told him that?

A. That is right.

Q. Did you ever find a case where a barge or tow rather had gotten out of the channel?

A. Yes, sir.

Q. That happens quite frequently, doesn't it?

A. Yes, sir; right often.

Q. And if you get out of a channel you are likely to ground a great many places?

A. Yes, sir; if you get out seriously.

Q. Does the river naturally at times vary more rapidly or less rapidly than a power station variation?

A. You mean from the cause of the power station?

Q. No; natural variations from rain and the like, are they more or less rapid than variations in discharge at the power stations?

A. Usually, we have had as much as a foot of rise an hour at Kanawha Falls.

2771 Q. From natural causes?

A. Yes, sir.

Q. And I think you said something about variations at the wicket dams or pools above those dams, do you maintain the levels in the pools above those wicket dams with mathematical precision?

A. Did I understand you to say above the roller dam?

Q. No, pools above the wicket dams?

A. As close as we can.

Q. You do have a good deal of variation, don't you?

A. Only at times.

Q. For instance, if you have the wickets up you won't put them down until there is a considerable depth of water flowing over the wickets?

A. We never, if possible, let it exceed over one foot.

Q. It may rise as much as one foot above then?

A. Only in some unusual case. For instance like we know water is coming behind it for instance like a wave from a power plant, you know it is going to subside, then we don't operate the wickets so often.

Q. Starting from pool level and assuming a rate of rise of one-half foot per hour for two hours would any interference with boats result?

A. Yes, sir.

Q. What would be the character of the interference?

A. At the dams while locking the foot of water in one hour will set up cross currents and make it hazardous to enter locks, and also increases the current in the chutes to such state it makes it bad to navigate.

Q. Are they dangerous after they have risen an hour?

A. 5/10 an hour?

Q. No, after they have risen for an hour, are they dangerous?

A. Surely, when entering a lock.

Q. Don't you often have conditions where the water is higher than that?

A. Yes, but we keep the pools down. If natural conditions we keep the pools at around normal, and if only going to be for a short period of time let more go over the crest of the dam than otherwise.

Q. In time of high flow, how can you prevent a rise of
2772 one foot or two feet in an hour?

A. You mean at the dam? We let the wickets down.

Q. How does that prevent rise in the upper end of the pool?

A. It doesn't on the wicket dam, we can't help anything, the dams must be taken out of the way; must be lowered. We keep it down to a certain stage at the dam.

Q. You can't keep it down when the water has risen?

A. Then we have an open river when the dam is lowered, nothing we can do about it.

Q. Is #6 pool dangerous when the water stands two feet above normal pool level at the upper end?

A. That doesn't happen very often, two foot——

Q. Will you answer the question.

A. It is dangerous.

Q. Starting from pool #4, or normal pool level in pool #6, if the power station at Marmet is in full operation, how much does the water rise at the head of #6 pool?

A. That will vary.

Q. If the pool is at normal pool level, and the power station is operating at full capacity, it won't vary, will it?

A. It certainly will cause us to operate our wickets at #6.

Q. Will that affect the rise at the upper end of the pool?

A. It will continue to be a certain wave, and will stay at that point.

Q. How much rise will there be?

A. I could not tell you. I would have to have the records to do that. It would fluctuate as we operate the dam.

Redirect examination by Mr. THOMPSON:

Q. How many complaints did you have on pool #6 before the Marmet dam was put in operation?

A. Very few.

Q. And how many have you had since?

By Mr. JACKSON. That is not proper redirect.

By Mr. THOMPSON. You were asking about the effect on the #6 pool.

By Mr. JACKSON. Counsel put him on on rebuttal and questioned him about groundings, and now he wants to take in another field.

By the COURT. He may answer.

2773 A. We have each time the power plant is operated, after the close off, we will have probably four or five complaints each time in that pool.

By MR. THOMPSON:

Q. Counsel asked you about the trouble at Houston landing. What caused the grounding at the Houston landing, if you know?

A. Because the first draw-down of the London pool [interrupted].

Q. The Marmet or London?

A. It was caused through the Marmet and London.

Q. Where?

A. Down by the Marmet pool, caused by that, but the reason of it was after the draw-down in the London pool, the water was closed off so suddenly it made a trough.

Q. You mean it made a trough in the Marmet pool?

A. That is right, Marmet did not shut their power plant down soon enough.

Q. Does the Government dredge at Charleston harbor, do you know?

A. Sometimes at the city landing only.

Q. Does the Government maintain the Charleston harbor otherwise?

A. No.

Q. Counsel asked you about boats getting out of the channel. They Don't get out of the channel on purpose, do they?

A. Certainly not.

Q. You were asked the first time you had considered or discussed waves with your superior. Was that the first time you had ever observed or considered waves?

A. No, sir.

Q. Did you ever see waves on the Ohio when you were on that river?

A. Yes, sir.

Q. And observe and study them?

A. I created them and followed them out.

Q. You mean down the river?

A. That is right.

Q. You spoke about the water going over the top of the

2774 dam. I don't know I got clear your explanation. I had some difficulty hearing you. You mean by that it goes over the roller gates?

A. Only one of them, one has a flap on it, they call it the "flap roller" and it is permissible to spill water over that.

Q. It doesn't mean it goes up all the way over the top of the dam, does it?

By Mr. JACKSON. I object to the question as leading.

By the COURT. Let him answer.

By Mr. JACKSON. Exception.

A. No.

Recross-examination by Mr. JACKSON:

Q. You have just told counsel in response to his question the water doesn't go over these dams except through the flap; didn't you tell me at various times the water did go over the gates and that you didn't know how deep it went over?

A. Just in a swell or surge when it would run over.

Q. Never any other way?

A. None I know of.

Q. You don't really know?

A. Sure I know.

Q. How do you know?

A. They tell me they will permit it to go over a few minutes.

Q. Who told you?

A. The lock master.

Q. What did you mean when you told me you didn't know how deep the water at times flowed over these gates?

A. I don't know.

Q. And you don't know how long at times it flows over those gates?

A. Not very long.

Q. You don't know how long, do you?

A. Not very long.

By Mr. THOMPSON. Why don't you say how long if you know?

By the WITNESS. I don't know the exact time.

By Mr. JACKSON:

Q. What was the date you observed this trough at Houston?

A. I don't remember the date.

Q. Did you see it?

A. The trough?

2775 Q. Yes.

A. No; I was at the landing and didn't pay any attention.

Q. You didn't see it?

A. I did not.

Q. Will you get the date for me?

A. I don't know where I would get it. We don't keep dates of those.

Q. You don't make any record of the troubles you investigate?
A. No more than where I have it.
Q. I would be very interested in knowing the time of the trough you saw. You can't help me out on that.
A. I don't know or I would tell you.
Q. And it dropped the water so much below the pool level it grounded?
A. It grounded.
Q. It dropped the water so much below the pool level it grounded?
A. As it went by, yes, sir.
Q. What year was that?
A. That was last year.
Q. Sometime in 1935?
A. Yes, sir.
Q. Would you say in summer or fall?
A. I don't remember the time.
Q. Probably in the middle of the summer?
A. I don't recall the time.
Q. You do recall it was some time last year, don't you?
A. Yes, sir.
Q. You are definite about that?
A. Yes, sir.
Q. You didn't know the plant was not in operation last year?
A. Sir.

Redirect examination by Mr. THOMPSON:

Q. Was this grounding before or after the Marmet
2776 project started operating?

By the COURT:

Trough or something.
A. It was one of their test runs.
Q. At the Marmet?
A. Marmet and London. I don't recall the time.
By the COURT. Where do you live?
By the WITNESS. Point Pleasant, West Virginia.
By the COURT. You work up and down from there?
By the WITNESS. Yes, sir.

2777 ROWLAND P. CASTLE

Direct examination by Mr. GATCHELL:

Q. Please state your name and present occupation?
A. Rowland P. Castle; Chief of the Operation Division United States Engineers Office, Huntington, West Virginia.

Q. How long have you held this position?

A. Since June 4th of this year.

Q. What has been your experience during the past five or six years?

A. In 1929 I started work for the United States Engineers Office at Huntington and at Marietta, Ohio. I was there about a year and a half, and about March 1931, was placed in charge of the Engineers Office at Catlettsburg, Kentucky. That office was in existence until August 1932. I was then transferred to the Point Pleasant office, which was formed at the time the Catlettsburg office was disbanded, and was there about six months as Assistant to the Engineer in charge of that office.

I was transferred then back to the Huntington office, and for a period of about two months I was called Assistant to the District Engineer who, at that time, was Major Herman.

When Major Herman left the District, the Navigation Section was organized, and I was placed in charge of that Section.

Q. And what were your duties when you were placed in charge of the Navigation Section?

A. It was my duty to make regular trips over the river, at least two a month, by a launch, and then to ride tows navigating the river in the Huntington District from their origins.

By Mr. JACKSON:

Q. When was that?

A. In August 1934, I was placed in charge of the Navigation Section.

2778 By Mr. GATCHELL:

Q. During the time that you were in charge of the Navigation Section, did you talk to the navigators and pilots on the Ohio and Kanawha Rivers regarding operating conditions?

A. Yes, while I was on these tows I, of course, would spend most of the time in the pilot houses, and that was the reason for being there, to see what difficulties they encountered and what remedies we could put into effect to overcome those difficulties.

Q. What are your present duties?

A. Chief of the Operating Division, and, as such, I am charged with the responsibility of the operation of the dams and pools and project depths, dredging, and expenditure of all funds in connection with the operation of locks and dams.

Q. Does Mr. Carpenter serve under you?

A. He does.

Q. Do you serve under the District Engineer?

A. That is correct.

Q. And all reports on the operation of the Ohio and Kanawha River dams are sent to you?

A. Yes, I get routine reports twice daily, and any extraordinary operations that occur we get reports by telephone.

Q. Do you get reports of gage readings on the Kanawha and Ohio Rivers?

A. Yes, twice daily.

Q. Do you get reports at Marmet?

A. I get reports at the time the gage heights are taken. That is a routine.

Q. How many such reports do you get a day?

A. Two a day—one in the forenoon and one in the afternoon.

Q. Does Mr. Carpenter report all complaints of navigation difficulties to you?

A. No. He reports only major complaints.

2779 Q. He reports major complaints to you?

A. Yes.

Q. In addition to those, you have, yourself, talked to many of the navigators on the Kanawha River?

A. Yes, sir.

Q. How long have you been advised of complaints of navigation difficulties on the Kanawha River?

Mr. JACKSON. We object to this testimony as not in any way proper rebuttal. Apparently it is an attempt to go further into proof of alleged navigation difficulties or groundings in the Kanawha River. They offered proof of that through Capt. Elsey, and now, if they are to reopen their case on that subject, we would be compelled to inquire into it and also offer evidence in surrebuttal. It seems to me improper for them to go into that further.

The COURT. The trend of these preliminary questions seem to do that, but I can't tell yet.

Mr. JACKSON. I did not want the witness to tell of the alleged complaints, and I think that is what the question called for.

NOTE.—The question was read as follows:

"Q. How long have you been advised of complaints of navigation difficulties on the Kanawha River?"

Mr. JACKSON. I submit, that is improper. It cannot have any bearing except going into further proof.

The COURT. You may answer that question.

Mr. JACKSON. Exception.

A. Since I was placed in charge of the navigation section.

By Mr. GATCHELL:

Q. Had the Marmet dam been completed at that time?

A. It had.

Q. How long since?

A. This was about two or three months after the actual completion of the Marmet dam.

Q. When was the power plant at Marmet placed in operation?

A. It was sometime after that. I think about December, 1935.

Q. Mr. Putnam testified in this case for the defendant that the rate of increase in the flow in the Marmet and Winfield pools would have no effect upon navigation until the discharge reached a point which he terms destructive.

Mr. JACKSON. I think it is where the current reached a point where it is obstructive.

Mr. GATCHELL. I only have to go by what he said. I will read from page 5285: "The rate would have no effect until the discharge had reached 30,000 second feet. At that point, or in the vicinity of that discharge, the current velocities begin to become what I would term destructive."

Mr. JACKSON. It is "obstructive."

The COURT. Go ahead with the question.

By Mr. GATCHELL:

Q. Would the rate of increase in flow in the Marmet pool have any effect upon the navigation prior to the time when it reached a high velocity?

A. Yes.

Q. How would it have any effect?

A. The rate of increase in flow—of course, a rise in the river will set up higher current velocity than was in effect before this rate of increase started, and that necessarily will slow down the operation of the tow in transit, and especially in the upper pool.

Q. When a tow is proceeding up-stream in the Marmet pool, does the velocity of the current have anything to do with the speed at which that tow can move?

A. Yes.

2780 Q. If that velocity is increased, what happens?

A. The speed of the tow is correspondingly decreased.

Q. Now, if the in-flow into the Marmet pool should be increased at a rate not exceeding 6,000 second-feet per hour, for not more than two hours, what would be the effect upon barges and tows operating in the Marmet pool?

A. During the time of the assumed increase in rate of flow, the velocities would be increased to some extent and the speed in transit would be decreased accordingly.

Q. What would be the effect upon tows and barges that are tied up along the banks?

A. The increased discharge would produce a fluctuation in the pool elevation and increase it, and after that discharge had receded, dropped down to normal again, there would be a corresponding drop. This would ground barges that were tied into the shore, loaded barges especially, with a clearance of three- or four-tenths under the barge.

Q. And is it necessary to tie up on the Kanawha River on account of fog?

A. Yes, very often.

Q. Do fogs occur very frequently?

A. During certain seasons of the year they do.

Q. Are any of those seasons during low water?

A. Yes.

Q. When a tow is tied up in a fog, does the navigator have an opportunity to pick the spot at which he will tie up?

A. No. The fact that he had to tie up on account of a fog does not allow him to pick the point that he will tie up. He has to tie up where the fog hits him.

Q. What is the method of tying up with spars?

A. That applies to floating plants, barges, and so forth, that might be moored in the harbors, and it might be the method
2781 to keep the fleet at a fixed distance from the shore line so it cannot be crowded in on the shore and grounded. It holds the tow in fixed relation to some definite object on the bank.

Q. How many barges are in tows operated on the Kanawha River?

A. The average tow would be about six barges.

Q. And how many spars would such a tow have to use in sparring out?

A. They would have to have at least two.

Q. How many tie lines would they have?

A. That depends on the judgment of the master of the boat. He should at least have one, if not two, head lines out on the head of his tow, and then a breast line, a spring line, and possibly two lines on the down-stream end of the tow.

Q. And how long does it take to get a tow sparred along the bank?

A. This sparring, of course, occurs in the harbors, and they are all equipped for that sort of work, and, even at that, it would take a period of from two or three hours, with five or six men, to spar it.

Q. If, while they are sparred out, there is a change in the stage of the river, up or down, in the Marmet pool, what effect does that have upon the sparring out?

A. Within certain limits the spars do not have to be changed, but when it goes beyond that limit it requires a resetting of the spars and practically starting from scratch.

Q. If they should have to change the spars, how long would that operation take?

A. If they are equipped with derrick boats, they can change rather rapidly, but, even at that, I do not think it could be done

in less than two or three hours, and, if they have to do it by hand, it is a much longer operation.

2782 Q. Are you familiar, in a general way, with the plans for the Winfield dam?

A. Yes.

Q. Do you know the elevation of the pool behind that dam?

A. Yes.

Q. What is the elevation?

A. 556.

Q. And what is the elevation of the present No. 6 pool?

A. 563.15.

Q. So that the elevation of the No. 6 pool will be raised how much?

A. It will be raised 2.85 feet.

Q. Is the No. 6 pool dug for any particular depth of channel?

Mr. JACKSON. I object to this as not proper rebuttal.

The COURT. That question itself is not, but it may lead to something else.

Mr. JACKSON. Exception.

NOTE.—The question was read.

A. Yes, at present, within the last two years, the control points in pool No. 6 have been dredged to sufficient depth to permit nine foot navigation in that particular section.

By Mr. GATCHELL:

Q. Major Putnam testified that if there were an increase in stages at the head of Winfield Pool at a rate not exceeding two feet per hour, the rate would have no effect until the discharge had reached 30,000 second feet; will you tell us what you think of that statement?

A. With the rate of not exceeding two feet an hour, there will be considerable fluctuation in pool elevation; there will be an increased velocity, and, in my opinion, at a maximum of two feet an hour, it would be practically impossible for a tow of any size to actually get into the lower approach to the locks.

Q. Why could they not get into the lower approach to the locks?

A. The increased velocity would just about prohibit the movement of that tow.

Q. What is the effect upon the water around the lower approach to the lock?

2783 A. If this discharge was coming through the roller gates of the dam, it would be spread over about 500 feet of river. That would set up one set of current, which would be bad, and especially bad on the tow at the time it had to cross

from the left side of the channel over to the right side of the channel in order to enter the lock, because the effect of that current would be pretty much broadside on the tow.

By the COURT:

Broad on which side?

A. The left side of the river. The lock is close to the left side.

By Mr. GATCHELL:

Q. Do they have to cross over the river immediately below the Marmet lock?

A. Yes, there is a rather short crossing there.

Q. What effect would it have upon boats moving up or down in the area now occupied by No. 6 pool, if there was this rate of increase in the Winfield pool?

A. The effect of the velocity will, of course, vary at different points in that pool, but down as far as lock 6 you have a sharp constriction of the channel at Blain's Island, and immediately above is Elk Chute, and there is a very narrow channel there, and at Donnally's Bar, immediately above Elk Chute, and a few miles above that there is a stretch of river known as the Levy Crossing, where there is a dredged channel of at least two miles, and it extends from below the Marmet dam to the entrance to the locks. Through these various constrictions, the velocity will be increased. Down bound, those in approaching these particular areas will necessarily have to slow down, because they will not be able to go through with safety at the same speed of water. They will actually be backing up in going through.

Q. What would be the effect upon a tow in the Marmet pool under a raise at the rate of a foot and a half and hour—not exceeding two hours?

2784 A. In the upper limits of the Marmet pool, from just below Paint Creek on up to the London lock, which is a distance of about three miles, you would have increased velocities and a considerable variation in the direction of the action of the current.

By the COURT:

Have you seen these conditions you are speaking of actually happen on the river, or are you speaking theoretically?

A. I have seen tows which could not get through the chutes because of the velocity of the water through the chutes.

By the COURT:

I am speaking of what you say as to the locks: Have you seen those conditions on the river which you narrated?

A. Yes.

By Mr. GATCHELL:

Q. You have been actually on the river when there has been a variation of flow below the Marmet pool?

A. Below the Marmet lock. Yes, I have been through there when tows were having considerable difficulty in getting through.

Q. Have you been on the Marmet pool when tows were having difficulty in getting up that pool?

A. Not in the Marmet pool, no.

Q. How long does it take a barge tow, proceeding up-stream, to pass through the length of the Marmet pool in normal low water?

Mr. JACKSON. I object to that as not proper rebuttal.

The COURT. It may be preliminary to something else.

Mr. JACKSON. Exception.

A. The average tow moves at a speed of between two and a half to three miles an hour under normal conditions. Under low water, it would take five or six hours.

By Mr. GATCHELL:

Q. How long would it take the same tow to pass up-stream through this pool if, at the time it entered the Marmet pool, the discharge in the head of the pool had increased at the rate of 6000 second-feet per hour, and, thereafter, progressively increased 6000 second-feet per hour for three additional hours?

2785 A. The tow would be slowed down by the same amount and the same velocity that the natural flow was increased, due to this increase of flow of 6000 feet.

Q. Would there be any difficulty in keeping in the channel in the Marmet pool?

A. In the upper limits of the pool, above old lock 3, I would say yes.

Q. And what effect, if any, would such an increase of flow at the head of the Marmet pool have upon an average two proceeding down-stream from the upper end of Marmet pool?

Mr. JACKSON. I object to the competency of the witness to answer this question. It is purely theoretical.

The COURT. I will let him answer it.

Mr. JACKSON. Exception.

A. It would increase the hazards that would naturally accompany the tow in navigating that section of the river which has not been extensively improved below the old low water channel.

By Mr. GATCHELL:

Q. Professor Thomas testified that some storage and re-regulation of power waves reaching Kanawha Falls could be secured on the Marmet pool. Under present conditions, do you permit fluctuations in the level of the Marmet pool?

Mr. JACKSON. I will ask a qualifying question. Mr. Castle, are he regulations or orders to the lock-master in writing?

WITNESS. I have never seen them.

Mr. JACKSON. Mr. Carpenter testified yesterday that they are in riting.

WITNESS. They may be, but I have not seen them.

Mr. JACKSON. You don't know anything about them?

WITNESS. No, sir.

Mr. JACKSON. Mr. Carpenter testified yesterday that they are in riting, and I object to any testimony without producing the ecord.

Mr. GATCHELL. This witness has qualified himself as being in harge.

The COURT. I understand that. This witness said that he doesn't now of any written orders about it.

Mr. JACKSON. Their own witness has testified that they are in riting.

The COURT. I do not recall what Mr. Carpenter said, but, pre-uming he said that, there is a difference of opinion or a different tatement between him and the chief.

Mr. JACKSON. Exception.

By Mr. GATCHELL:

Q. Under present conditions, do you permit a variation in the levation of the Marmet pool?

A. The lock-master at Marmet is instructed to maintain his ool elevation at one-tenth of a foot below the crest of the dam, hich is equivalent to a stage of 17.9 feet on the upper gage. The peration of the power plant in connection with that dam allows he use of an additional two-tenths of a foot on the gage right at he lock, which means that the fluctuation can be from 18.0 to 17.7 n that gage.

By Mr. GATCHELL:

Q. At what elevation do you keep your working pool level?

2786 A. At 17.9.

Q. Which is 1/10 foot below the crest of the roller gates?

A. Yes, sir.

Q. As I understand you, you permit them to draw down 1/10 of a oot below your working pool elevation?

A. Yes, sir.

Q. I show you paper marked for identification Govern-

2787 ment Exhibit #263, purporting to be a letter signed by John F. Conklin, Lt. Col., Corps of Engineers, District Engineer, addressed to the Kanawha Valley Power Company, Charleston, West Virginia, under date of June 26, 1936, subject,

"Kanawha River pool fluctuations resulting from operation of the Marmet and London hydro-plants", and ask you if you recognize that paper?

A. Yes, sir.

Q. What is it?

A. It is a copy of a letter that was written in the Huntington, West Virginia office, as a result of a conference between Mr. McCormack and Mr. Ellis of the Kanawha Valley Power Company, at which conference a method of operation was proposed and tentatively accepted, which would result in the [interrupted].

Q. Were you present at the conference?

A. Yes, sir.

Q. And was any agreement reached in that conference?

Q. What was that agreement respecting?

A. The operation of the power plant.

Q. Was that agreement reduced to writing?

A. The agreement was reduced to writing in a letter to the Kanawha Valley Power Company.

Q. Is this the letter?

A. It is a copy of the letter.

(Said letter, Exhibit 263, being identical with Exhibit 608 marked for identification, was offered in evidence.)

(Exhibit 609, being Letter dated July 10, 1936, to U. S. District Engineer Office, Huntington, West Virginia on "Kanawha River Pool Fluctuations Resulting From Operation of the Marmet and London Hydro Plants"—from Kanawha Valley Power Company, was offered in evidence.)

Q. You are in charge of the operation and maintenance of these pools in the Kanawha River?

A. Yes, sir.

Q. Are dredging operations carried on in the pools?

A. Yes, sir.

Q. Where do you have the most difficulty on the Kanawha River?

By Mr. JACKSON. I object to that as not proper rebuttal.

By the COURT. It may be preliminary to something else.

A. At the lower approaches of the locks.

By Mr. GATCHELL:

2788 Q. What do you mean by lower approaches?

A. That portion of the pool within from right up to the lock gates downstream in some cases as far as two miles.

Q. Is that in the deepest part of the pool?

A. No, sir.

Q. Is it in the shallowest part?

A. Yes, sir.

Q. Mr. Castle, when you were telling about sparring out boats, I didn't quite follow you. Can you tell the Court how much of a rise would affect the sparring?

A. That would depend entirely on the length of the spars. I could not make a general statement about that.

Q. What is the principal complaints you receive of navigation difficulties in the Kanawha River?

By Mr. JACKSON. I object to that as not proper rebuttal.

By the COURT. Objection overruled.

By Mr. JACKSON. Exception.

A. Fluctuating pools, changes in flow.

Cross examination by Mr. JACKSON:

Q. Mr. Castle, how old are you?

A. Thirty-six years old.

Q. What did you do before you went to work for the Government in 1929?

A. I was in the contracting business.

Q. Where?

A. In Huntington, West Virginia.

Q. And how long had you been in that business before 1929?

A. Since 1923.

Q. That is, you have been in that business ever since you were old enough to do anything, until you went into the employ of the Government; is that right?

A. No, sir; I had worked before that, and had been to school before that.

2789 Q. Did you go to any professional school?

A. I am a graduate of the United States Military Academy, at West Point.

Q. When did you graduate?

A. 1923.

Q. And have you ever been an officer in the Corps of Engineers?

A. No, sir.

Q. You graduated in 1923?

A. Yes, sir.

Q. Then did you go into the contracting business?

A. Yes, sir.

Q. When?

A. About two months after graduation.

Q. And you continued in that until 1929?

A. Yes, sir.

Q. And then accepted this employment in the Engineer Office as a civilian engineer, at Huntington?

A. I was employed at Huntington and sent to Marietta.

Q. Now what kind of construction work were you doing before you went with the Government?

A. General construction, buildings entirely.

Q. You were not engaged in navigation operations before you went with the Government?

A. No, sir, not in the contracting business.

Q. And any experience you have had in having anything to do with navigation has been since you went with the Government?

A. Yes, sir.

Q. You have not personally ever navigated boats?

A. No, sir, I am not a pilot.

Q. And you have never been in the navigation business your-s'lf?

A. No, sir.

2790 Q. Now, assuming Mr. Castle that the flow in the future Winfield pool, at a given time, is 8,000 second feet, will the current be any different whether that flow was attained in the course of two hours or in the course of ten hours?

A. Yes, sir, if the current or flow is attained in two hours the current will be in excess of that during that time than if you attained it in ten hours.

Q. The fact is, is it not, with a flow of 8,000 second feet in the Winfield pool, the current will be the same regardless of how rapidly the river rose, prior to that time?

A. If I understand the question, it is after the flow of 8,000 second feet is reached it will be the same?

Q. Be the same at that time?

A. Same as what? I don't understand.

Q. I want you to tell me whether, in your opinion, when a flow of 8,000 second feet exists at the future Winfield pool, the velocity which will prevail at that time will depend upon the rate of rise in the river prior thereto?

A. A flow of 8,000 second feet will produce a certain current, and that current will be maintained regardless of the rate of rise prior to that.

Q. That is, with a given flow, a certain current will result which may or may not be obstructive to boats, depending upon the velocity of current, isn't that about right?

A. Any flow is obstructive to a boat in transit.

Q. That is your opinion is that every boat going up a river is obstructed because there is some current in the river?

A. Yes, sir, it retards its progress.

Q. Your testimony is based on the theory there is always some obstruction to navigation unless you have completely slack water, with no movement in it?

791 A. Any velocity, natural or otherwise is an obstruction.

Q. That is the sense about which you have been testifying bout obstructions here this morning, isn't it?

A. In my testimony this morning I have based my increases in elocity due to these increases in stage or discharge on an assumed ow in the river, and assumed velocity therefrom.

Q. What is the hydraulic capacity of the Marmet power station, pproximately?

A. I have been told about 10,000 second-feet.

Q. Isn't it about 9,000 second-feet?

A. I don't know the capacity, at the present—the turbines at resent—are operating under a higher head than they will be when he dam is completed.

Q. What is the average flow of the Kanawha River at the Marmet am?

A. In what season?

Q. The average flow?

A. I don't know.

Q. Isn't it in excess of 13,500 second-feet?

A. I don't know.

Q. From your familiarity with the river and river conditions, ouldn't you say that is about right?

A. I wouldn't say it is right. I would say it is probably in excess f that throughout the year.

Q. Doesn't the average flow of the Kanawha River at Marmet xceed 10,000 second-feet more than fifty percent of the time—I on't mean the average, but the flow at Marmet, doesn't it exceed ,000 second-feet more than fifty percent of the time?

A. I don't know.

Q. Would you say that is not right?

A. I don't know.

792 Q. You testified I think that in your opinion an increase at the rate of 6,000 second-feet per hour in any of these avigation pools existing in the future would create an ob-ructive current in those pools. Assuming, Mr. Castle, a flow of 000 second-feet in the future Gallipolis pool, and assuming that ow was increased by 6,000 second-feet, what would be the resulting locity of current? [Interrupted.]

A. I don't know.

Q. What would be the velocity of current in the Winfield pool sulting from a flow of 6,000 second-feet?

A. I don't know what the velocity of the current would be.

Q. You never have made any study of the current velocities that ould result on any of these pools from various flows, have you?

A. No, sir.

Q. And you don't know, of course, what current velocities would exist in these various pools from a given flow or would result from a particular increase in flow in those pools, do you?

A. I don't know about the velocity, no, sir.

Q. Have you observed, Mr. Castle, whether navigation ceases on the Kanawha River, when the flood flows get as high as 30,000 second-feet?

A. I have seen boats unable to get through certain points on the Kanawha when the flow was less than 30,000.

Q. I am asking if navigation ceases on the Kanawha at 30,000 second-feet?

A. No, sir.

Q. Does it continue, Mr. Castle, when the river is over-flowed?

A. Yes, navigation continues.

Q. Do you know what the current in the river is when it has risen to a stage where it is flowing and inundating the lands where houses are built along the river?

2793 A. No, sir; I don't know.

Q. Be pretty high, wouldn't it?

A. No, sir; be lower.

Q. That is your opinion, the higher the flow the lower the current?

A. At a certain point in the stage of the water.

Q. You testified, as I understood you, if a boat were operating on the London or Marmet pool, and there were a decrease in flow into that pool of, for instance, 6,000 second feet in an hour, it would result in grounding of the tow or the boat; is that about right?

A. No, sir, I don't think I mentioned grounding the boat.

Q. You don't think it would ground, do you, as a result of there being a decrease in flow at the London or Marmet pool of 6,000 second feet?

A. It might or might not, depending on where it was caught at the time.

Q. You know if the boat were not loaded beyond the project depth and the pool did not drop below the project depth, there would be no grounding as a result of the decrease in flow of 6,000 second feet, do you not?

A. If he were in the channel there would be no grounding.

Q. If you get out of the channel you are always in more or less hazard of having a grounding?

A. Surely.

Q. Now, Mr. Castle, you said that when boats were sparred out, that if there is any drop in water level, or at least under some conditions, drops in water level, that it would result in the ground-

ing of the barges. You personally, of course, have not sparred out boats, that has not been any part of your business?

A. I have supervised the sparring out of our own fleets, yes, sir.

2794 Q. The sparring out of the boat is to allow for rise and fall of the water level, isn't it?

A. In part.

Q. And it is the common and usual practice in river navigation to spar out boats for that reason unless you have in some places a dock or wharf constructed, which is not likely to be often?

A. Sparring out is common practice.

Q. And it of course follows when you spar out your barges that so long as there is not a recession of the water that is greater than the amount of clearance you have allowed under your barges, there will be no grounding, is that true?

A. That is right.

Q. And the matter of having these fluctuations and dealing with certain fluctuations within those limits is a part of practical river navigation, isn't it?

A. Surely.

Q. And when there is a recession, there is no effect unless it may be in some instances the necessity of adjusting the hawser, is that what you use to bind the boats, or how is that, a rope as I understand it?

A. It requires considerable more adjustment than a rope. As the river recedes it will be necessary to remove your spars.

Q. That would only be true if you had a recession greater than the amount of clearance provided by your original sparring out?

A. Yes, sir.

Q. And as long as you do not have a recession that does not exceed that, you would not have any such need?

A. That is right.

Q. And isn't it true every time you spar out, you have two or three feet of water under your barges?

A. No, sir.

2795 Q. Isn't that generally true?

A. Not always; no, sir.

Q. But isn't it generally true?

A. I don't think it is.

Q. You would not be willing to say it isn't?

A. In the majority of harbors on the Kanawha River it isn't the case.

Q. You wouldn't say it isn't generally two feet, would you?

A. I don't know of any with two feet clearance.

Q. It all depends on how far they are sparred out and the slope of the bed, doesn't it?

A. Not always, it depends on the depth of the harbor. You can't spar a fleet out sixty or seventy feet, lots of places if you did that the fleet would be in the middle of the river.

Q. In places where there are a perfectly flat, shallow landing, you have a situation where there has never been provided a landing or harbor?

A. These boats are sparred out in what they have provided.

Q. And what they have provided is merely a question of the amount of dredging and work they care to do in providing a landing, by private interests, isn't it?

A. It is up to private interests to provide their harbors.

Q. On these wicket dams, Mr. Castle, navigation proceeds when the wickets and then the passes are down, and the other wickets up?

A. No, sir; that condition never prevails.

Q. The wier goes down first?

A. Surely.

Q. And does navigation then continue?

A. Yes, sir.

Q. And what is the flow in the river under those conditions?

A. With the entire wier down?

2796 Q. Yes.

A. At lock #6 or where?

Q. You can give me different locks.

A. At Lock #6 all the wier will be down at a stage of about four feet on the Falls gage, at about that.

Q. Will the pass still be up?

A. Yes.

Q. So that they will be using the lock?

A. Yes.

Q. And what will be the flow at that point in the river under those conditions?

A. I would have to have a rating chart to see what that discharge is. If I remember right, it would be around 13,000 or 14,000 second-feet, or something like that.

Q. So this navigation continues with a flow of around 14,000 second-feet through the locks?

A. Flow through the locks?

Q. No; the flow in the river is 14,000 second-feet?

A. That is correct.

Q. You testified about your view of the effect of increases or decreases in flow of 6,000 second-feet per hour. The decrease would, of course, decrease the current, wouldn't it?

A. That is correct; yes, sir.

Q. And would that have a compensating beneficial effect on navigation?

A. Of course, the decrease in flow is going to benefit it just as much as the increase in flow hurts the other tow, but as far as navigating any one boat is concerned, I don't think the change is——

Q. The only point I am getting at is, Mr. Castle, if you assume an equal variation up and down, below a certain established flow,
2797 the increase will tend to increase the current and the decrease will tend to beneficially decrease the current that would otherwise exist; isn't that true?

A. Yes, it makes it easier. A decreasing river makes it easier.

Q. You stated, I think, that if there were an increase of 6,000 second-feet per hour for two hours that that would create current so that the tows or barges couldn't go upstream?

A. At certain locations that rate of rise would stop traffic.

Q. Mr. Castle, assuming a previous base flow of 1,000 second-feet, will you tell me what current would result from an increase of 6,000 second-feet in one hour at the Marmet or Winfield pools?

A. No, sir; I can't tell you the velocity.

Q. That is at the end of the hour?

A. I can't tell you.

Q. Will you tell me what current would result at the end of two hours?

A. I couldn't say that.

Q. Of course, if the original flow were 1,000 second-feet and it increased even in two hours at the rate of 6,000 second-feet, it would still be less than the flow at which you maintain the use of the lock in the wicket dams under present conditions rather than putting them down and using the navigable pass, wouldn't it? That is, you said a while ago that when the flow in the river at the wicket dams would be around 14,000 second-feet and the weir down, navigation would still be using the lock; is that right?

A. Yes, sir.

Q. So that under the conditions I have assumed, it is a mere matter of mathematics.

A. You mean a flow of 7,000 second-feet in the river?

Q. At the end of the two hours there would be a flow of 13,000 second-feet in the river under the conditions I assume?

A. Yes. The locks would still be in operation.

2798 Q. And that would also be less than the average flow of the Kanawha River at Marmet, wouldn't it?

A. I don't know about that.

Q. You spoke something about the current below the locks at London and Marmet. Is it not a fact that the nature of those

currents was determined by model tests made by Professor Thomas of Carnegie Institute of Technology?

A. I don't know.

By Mr. JACKSON:

Q. Mr. Castle, what is the capacity in kilowatts of the installation at Marmet—about 15,000 kilowatts?

A. I have been told that, yes.

Q. I think you said your understanding is that the hydraulic capacity of the installation is 9,000 or 10,000 second-feet?

A. That is my understanding, yes.

Q. You testified about Exhibit 263, the letter of Col. Conklin to the Kanawha Valley Power Company, and I want to direct your attention to paragraph "C" with a subparagraph 1, at the bottom of page 2, reading as follows: "Pending completion of the central control system, current rules for manual operation will be modified at once with the view to minimizing fluctuations as follows:

"1. Power increment, both positive and negative, will be applied at the rate of 5,000 kw., applied gradually over a period of 60 minutes, instead of 30 minutes, as at present."

I ask you whether I am right in understanding that to mean that the rate at which the power load is to be added to the Marmet power plant, or taken off of the Marmet power plant, shall be 5,000 kw. per hour?

A. The paragraph you referred to states that it will be applied in increments, or taken off in increments.

By Mr. JACKSON:

Q. I want to see if I am right in understanding that the load will be added or taken off at a rate which will be 5,000 kw. 2799 per hour, or not exceeding that?

A. Gradually applied.

Q. That is one-third of the capacity of the plant, isn't it—15,000 kw.?

A. That is my understanding, yes.

Q. And that would also be equivalent, speaking in terms of hydraulic capacity, to 3,000 second-feet per hour, would it not?

A. Assuming 9,000 second-feet.

Q. If you assume 10,000, it will be 3,300?

A. Yes.

Q. So under this rule of operation the flow of discharge of the Marmet power station may be increased 3,000 second-feet in an hour or decreased 3,000 second-feet in an hour; is that right?

A. That is correct.

Q. I also direct your attention to subparagraph 2 of Paragraph "C" at the end of Government Exhibit 263, reading: "Within the limits of +0.0 to −0.3 at the Marmet upper pool, the operation of Marmet plant will be started in advance of the London plant and closed in conjunction with the London Plant to equalize, as much as possible, the level of the lower pool at Marmet. Compensation of the heavier peak for shorter duration with incidental fluctuations will be carried primarily at London but in this operation due care will be exercised at both plants to avoid drawing the lower pool at London below normal."

The lower pool at London is the Marmet pool?

A. That is the upper end of the Marmet pool.

Q. And by this reference to peak is meant a variable operation of the plant, isn't it?

A. Peak, as I understand it, is the maximum—either discharge in water or generation of power.

Q. It says "heavier peak for shorter duration." That means you would have a larger flow for part of the time; is that right?

2800 A. During the length of the peak, yes.

By Mr. JACKSON:

Q. And this exhibit 263, you have identified, as I understand it, as the regulations that were promulgated by Col. Conklin and that now obtain; is that right?

A. Tentatively; yes, sir.

Redirect examination by Mr. GATCHELL:

Q. Counsel asked you if you knew what velocities would result from the discharge at a certain number of cubic feet. You said you didn't know. Do you know that the Kanawha River would have different velocities at different stages?

A. At certain points, yes.

Q. Counsel asked you about sparring out of boats and may I ask you this: Do navigators wait until boats have gone aground before changing their spars when the river is falling?

A. No; when they know the river is falling they will watch pretty closely and they will try to get the boats moved out just ahead of the time they ground.

Q. So that the river might stop falling after they had sparred out; and they still would have gone through the operation?

A. That is correct, yes, sir.

Q. You said that private interests maintained the landings and harbors along the Kanawha River. Who maintains the water level?

A. The Engineer Department of the United States.

Q. Do private interests maintain landing places all up and down Kanawha River where they can tie up in fog?

A. Not to my knowledge.

Q. This agreement that counsel referred to as Exhibit #263, the letter signed by Col. Conklin, under date of June 26, 1936—is that a final agreement?

By Mr. JACKSON. I object to the competency of the witness to answer that question.

By the COURT. He has said two or three times it was a tentative agreement.

2801 By Mr. GATCHELL:

Q. By that do you mean it can be changed at any time?

A. Yes, sir.

Recross-examination by Mr. JACKSON:

Q. Mr. Castle, after the four new dams are completed and in operation and the three power stations, the two at London and Marmet and the one at Winfield, will the navigation interests be better off than under the old conditions with the ten low dams in the Kanawha River before any of these improvements were made?

By Mr. GATCHELL: That is certainly not a proper question. There are many considerations that might enter into it.

By the COURT. Objection sustained.

By the COURT:

Q. Mr. Castle, supposing the gates of the Marmet dam are raised as high as possible, in an effort to discharge water from the pool, what is the discharge that will occur when the pool is full? I realize that if the pool level drops, of course the discharge will be less but on a full pool if you raise the gates as high as possible, how much water will run out, do you know?

A. You mean the roller gates in the dam?

Q. Yes; the roller gates in the dam?

A. Well, I have no way of being able to answer that, sir.

2802 HARRY R. BRIGHT

Direct examination by Mr. GATCHELL:

Q. Will you state your full name and present occupation?

A. Harry R. Bright. Lock Master at Lock and Dam #6, Kanawha River.

Q. How long have you been Lock Master at Lock and Dam #6?

A. Nearly 7 years.

Q. How long have you lived on the Kanawha River?
A. All my life.
Q. Is the dam at Lock #6 a fixed crest dam?
A. It is a movable dam, Chanoine Wickets.
Q. And what is the normal pool elevation at Dam #6?
A. 563.15.
Q. What is the gage height?
A. 15.25.
Q. Are you in control of the pool level?
A. Yes, sir.
Q. And at what elevation are you instructed to keep that pool?
A. Got to keep it above normal pool, not to be under normal pool.
Q. At what stage of the river do you raise your wickets?
A. When our dam is down we start raising our wickets at about 11 feet on the lower gage.
Q. And what would be the reading on the Kanawha Falls gage at that time?
A. Between 4½ and 5 feet.
Q. At what stage on your lower miter-sill gage do you have your entire dam up?
A. Near about 7 feet, that is at low water.
Q. Would it be needled?
A. It would be needled.
2803 Q. In times of low water during the years prior to completion of the London and Marmet power plants, how frequently did you ordinarily operate or maneuver the wickets on Dam #6?
A. Near about 200 times during low water season.

By Mr. GATCHELL:

Q. Is that since the completion?
A. Since the completion of the Marmet dam.
Q. How about prior to completion of those dams?
A. It would be very few—six, maybe eight—times a year on an average at low water.
Q. How many times do you operate the wickets on your dams a day?
A. Average about four times a day.
Q. Are you informed as to the discharge past the Marmet dam?
A. By telephone.
Q. Who informs you?
A. The Lock Master or some of his crew who is in charge at the time. The Lock Master may not be there at all times.

By Mr. JACKSON:

Q. The Lock Master where?

A. At Marmet.

By Mr. GATCHELL:

Q. Do they notify you whenever there is a change in the discharge?

A. Yes; the same thing.

Q. How many men does it take to operate the wickets in ordinary low water under present circumstances?

A. Three.

Q. A three-man crew?

A. A three-man crew, yes.

Q. About how long does it take?

A. It takes about an hour or a little better than an hour for each operation.

Q. And what is the effect upon the normal current below the dam and near the lock entrance when you lower some of your wickets?

A. It sets up a back-slash, we call it, and the boats has difficulty getting in the lock. They have to put out a line to take them into the lock. It is an out-set current.

By Mr. JACKSON. May it be understood that all of this testimony is subject to our objection as not proper rebuttal?

By the COURT. Yes.

By Mr. JACKSON. And exception.

2804 By Mr. GATCHELL:

Q. Are complaints made to you when navigators have difficulty near Dam #6?

A. Yes, sir.

Q. Do you make investigation of such complaints?

A. Yes; I try to remedy that by our pool level.

By Mr. JACKSON. I think another question should be asked if he is going to pursue this further.

By Mr. GATCHELL:

Q. What do you do?

By Mr. JACKSON. I object to their going into this question further. It seems to me it is new.

By the COURT. I think so, too. I allowed these other questions to be asked on the theory that they were preliminary, getting to something probably in rebuttal of the evidence introduced by the defense, but these questions certainly are not in rebuttal.

By Mr. GATCHELL. Your Honor, all that we are attempting to do by this witness, whose testimony on direct will be very short, is to see if Major Putnam was correct when he said that the rate of

ge, increase or decrease in the flow of the river past the Mar-
lam, would have no effect upon navigation, adverse or other-

the COURT. Let us get to that then.
Mr. GATCHELL. These questions that I have been asking are
minary to that because we want to show that this man has
ledge of what happens and how it happens and what naviga-
interests have to say about it.
Mr. JACKSON. That would be an effort to bring in further
mony on the line of Capt. Elsey and would be improper.
Mr. GATCHELL. May I proceed?
the COURT. You may go ahead.

By Mr. GATCHELL:

Did you answer the question as to what you did when they
plained to you about navigation difficulties?
I investigate it.
Mr. JACKSON. May our exception be noted?
the COURT. He investigates and that is all.

By Mr. GATCHELL:

Go ahead.
the COURT. No; that is enough. He investigates it.

By Mr. GATCHELL:

Do you operate your pool in any way?
Yes; if our pools are down we immediately caulk and try
ise the pool and if we haven't got the water sufficient we call
Mr. Marshall and ask for water if he has it to spare.

By the COURT:

Mr. Marshall is the Lock Master at Marmet, isn't he?
That is right; yes, sir.

By Mr. GATCHELL:

Does he give you the water?
At times.
If he does not what do you do?
I call Mr. Carpenter.
And what does he do, if you know?
He investigates it, as far as I know. That is as far as I
with it.
Have your navigation difficulties increased since the comple-
and the operation of the London and Marmet plants?
By Mr. JACKSON. I object to that as not proper rebuttal.
By the COURT. He may answer it.
By Mr. JACKSON. May our exception be noted?
A. Yes.

By Mr. GATCHELL:

Q. If your dam has all of the wickets down and you receive word from the Marmet dam that the power plant has been shut down, what operation of your dam is necessary?

A. Well, if it down just below 11 feet, we have to put the dam up to the project depth above.

2805 By Mr. JACKSON. Will you read the answer.

(The answer was read as above.)

By Mr. JACKSON:

Q. Is that what you said?

A. Put the dam up to raise the pool so that navigators can go up and down the river.

By Mr. GATCHELL:

Q. Do the changes in stage at the upper end of your pool cause any difficulty in the operation of your dam?

A. Changes in the pool? Yes; it does.

Q. Does it cause you to operate your wickets more frequently?

A. Yes, sir.

Q. Does the rate of increase in flow at the upper end of your pool cause you to operate your dam more frequently.

A. Yes, sir.

By Mr. JACKSON. I object to that question as he hasn't shown any competency to consider rates of increase.

By the COURT. The answer may stand.

By Mr. GATCHELL:

Q. And would the same thing be true of the rate of decrease?

A. It would.

Q. You say you have lived on Kanawha River all your life?

A. Yes, sir.

Q. Can you stand on the bank of Kanawha River and observe a rise in that river of as little as 5/10 of a foot in five hours?

A. Well, yes.

Q. Do you have any difficulty in observing the rise in stage of the Kanawha River?

A. I do.

Q. Where were you living in 1930?

A. Lock #6.

Q. And where was your home?

A. Lock #6.

Q. Where is that located?

A. Four miles below Charleston.

Q. Where was the water supply of the City of Charleston obtained during that year, if you know?

A. Elk River.

2806 Q. Do you know if they experienced any difficulty with the water supply during that year?

By Mr. JACKSON. I object to that as irrelevant and immaterial.

By the COURT. What is that in rebuttal of?

By Mr. GATCHELL. This just goes to the testimony of Dr. Mead with respect to the City water supply of the City of Charleston and this witness was there during the year 1930.

By Mr. JACKSON. What is it going to rebut?

By the COURT. What statement did he make that you wish to deny?

By Mr. GATCHELL. It is in rebuttal of this specific point that was brought out by the witnesses for the defendant, namely: Dr. Mead, and I forget the other witness, that the water supply for the City of Charleston did not come from the Kanawha River, and, if this witness knows, I would like to ask him three questions on it.

By the COURT. He just said it came from the Elk River.

By Mr. GATCHELL:

Q. Is that true during the entire year?

By Mr. JACKSON. I object to that as not proper rebuttal.

By the COURT. I will let him answer.

A. They had trouble with water. They had to lay an extra line through the City of Charleston to the river to supply the water.

By Mr. GATCHELL:

Q. To what river?

A. Kanawha River.

Q. Do you know at what time they got the water supply from the Kanawha River?

A. No, sir.

Cross-examination by Mr. JACKSON:

Q. What do you mean by a rate of decrease in stage?

A. That is when the river is falling.

Q. You don't mean by rate——

A. (Interrupting.) We don't get it by rate—we get it by tenths.

Q. You don't know what a rate of decrease of increase means, do you?

A. Decrease is falling and an increase is rising.

Q. Any answer that you made that involved the questions of rate were made without any understanding on your part as to what that means, weren't they?

A. I don't know what rating is.

Q. Am I right in understanding you, Mr. Bright, that you can stand along the Kanawha River and, if that river is falling at the rate of 1/60 of an inch a minute, that you can stand there and observe that fall?

By the WITNESS. (Interrupting.) No, sir; I cannot.

By MR. JACKSON:

Q. Mr. Bright, assuming that you are standing on the bank of the Kanawha River, I will ask you if you can observe an increase in the stage of the Kanawha River at the rate of 1/60 of an inch or less, in a minute?

A. Yes, sir; I can tell when the river is rising.

Q. You can actually see it rising?

2807 A. No, sir; but I can tell that it is rising by the different currents the same as if a man poured water there and made a current.

Q. If there is a change in stage upward, as little as 1/60 of an inch in a minute, you can observe the changes in the river, as you look at it. Is that right?

A. I can tell when the river is rising; that is all.

Q. You can tell when the river is rising with that small change?

A. You can tell when the river is rising.

Q. Suppose that you were standing on the bank of the Kanawha River and look at it and went away and came back in five minutes, and it had risen 1/16 of an inch, could you tell it from looking at the river?

A. We can tell when the river is rising, but I don't know how much.

Q. If you were standing there and then went away and came back in five minutes, it is your testimony that, in that interim, the river had—if the river had increased or risen—the stage had risen 1/16 of an inch, that you could recognize that with your eye?

A. I could not recognize it as 1/16, but I could recognize that it is rising.

Q. It is your testimony that, if you were standing on the bank of the Kanawha River and looked at it and went away and came back in five minutes, and there had been a rise in stage of as little as 1/16 of an inch, you could look at the river and say, "I can tell by the currents on the river that the river has risen since I was here."

A. I can tell that it is rising, but not that it was 1/16 of an inch.

Q. I just wanted to know how finely drawn your judgment was. You stated that you have operated the wickets at Number 6 Dam from time to time?

A. Yes, sir.

2808 Q. And you said that you now operate them perhaps 200 times a year?

A. Yes; approximately 200 times a year.

Q. You don't mean to imply that you operate all of them, do you?

A. No, sir; just to take care of the waves from the Marmet turbines.

Q. What you mean is that you adjust a few wickets during this time?

A. If we kept the dam up and the waves come when we have too much water over the top to swing the wickets, it would probably do damage to the dam.

Q. The point is, what you do under these circumstances is to adjust a few wickets. You don't put the wickets all down?

A. No, sir; we don't put them all down.

Q. It is perhaps only a few that you moved?

A. Yes, sir.

Q. And it is part of your duties, as lock-master, with your crew, to move the wickets, as may be required?

A. Yes, sir.

Q. You are directed to do that by Colonel Conklin, or through him?

A. Yes, sir; through him.

Q. Has your pay been increased since you have been moving or adjusting the wickets oftener?

A. No, sir.

Q. You get the same pay that you got for a number of years back, don't you?

A. Yes, sir.

Q. Have you any more men working for you now than you had?

A. The same men.

Q. The same men exactly?

A. Yes, sir.

2809 Q. You understand that your dam is to be taken out as soon as Winfield is completed?

A. Yes, sir.

Q. And there will not be any wicket dams then, I take it?

A. Not at Lock No. 6.

Q. Do you know how much volume of water must flow past your dam before currents, that are troublesome or an obstruction to navigation, arise?

A. No, sir.

Q. You have not made a study of that kind?

A. No, sir.

Q. And you would not have any idea that a flow of 2,000 second-feet or 6,000 second-feet, or 8,000 second-feet, or 10,000 second-feet would create these currents?

A. I don't know a thing about it.

Q. Nor any other measure of volume of water, such as acre feet or gallons or any thing of that character?

A. No, sir.

2810 Direct examination by Mr. GATCHELL:

Q. Will you state your full name and present occupation?

A. W. H. Marshall; I am lock-master at Marmet.

Q. And what are your duties as lock-master?

A. To control the upper pools at Marmet Dam.

Q. What is the elevation of upper Marmet pool at its working elevation?

A. The elevation is 589.9,—0.1 below the crest of the dam.

Q. Do the rollers constitute the crest of that dam?

A. Yes, sir.

Q. When the water falls below the working pool elevation, how much of a drop do you permit before you take any steps to remedy that?

A. If it goes below that one-tenth, which is below the crest, we try to rectify it and bring it back up.

Q. If it goes below 589.9?

A. If it goes one-tenth below 589.9, we try to bring it back.

Q. What do you do?

A. We call the operator that operates the power turbines and ask them if they won't restore it.

Q. And how can they restore it?

A. They could restore it by decreasing the opening through the turbines.

Q. They can restore it by decreasing the opening through the turbines?

A. Yes, sir.

By the COURT:

Q. You call the operator at Marmet, do you?

A. Yes, sir.

Q. And this pool will be brought back to the proper level by the inflow from London?

A. Yes, sir; by decreasing the discharge through the turbine.

2811 Q. By decreasing the discharge through the turbines at Marmet?

A. Yes, sir.

Q. And then that inflow from both will build it up?

A. Yes, sir.

2812 By Mr. GATCHELL:

Q. Does the working pool elevation vary more than .3 of a foot?

A. It does; yes, sir.

Q. What are your instructions in regard to any variation?

A. We are instructed not to let the water go over the dam, if, by ordinary manipulation, the dam will prevent it.

Q. The manipulation of the power plant?

A. The manipulation of the power plant or Marmet Dam.

Q. Does the power company always respond to your request to change the discharge through their turbines?

A. Usually they do; however, once or twice, they would not do it.

Q. What happened the times they would not do it?

A. The operator told me that he had instructions from the Cabin Creek Station that he could not change it.

Q. What did you do?

A. In one case, I called the Cabin Creek Station and they told me—I asked them if they would not decrease their discharge through the turbines, so as to build the pool up, and he told me it was not any of my business, so I called up Mr. McCormack, but he was out of town, and that is as far as it went.

By Mr. GATCHELL:

Q. Major Putnam said that there would be no adverse effect on navigation, if the rate of increase of the stage of Marmet pool did not exceed 1½ feet per hour up to the point where the critical discharge of 22,000 second feet obtained. When there is an increase in the stage of Marmet pool of 1½ feet per hour, what do you do?

A. Why, we get prepared to operate the roller dam and operate it as that water gets to it.

Q. And do you know if a rise of water at any such stage as that has interfered with navigation operating on the Marmet pool?

2813 A. The upper three miles of our pool—Marmet pool, is worse—it is the worst part, and navigators have complained to me that they had considerable trouble.

By the COURT:

Q. What is the cause of it?

A. The increase or excess currents.

Q. At various times, under certain conditions?

A. Well, low water when we have just project depth, they have some treacherous chutes through there—narrow channels, and the additional discharge down there—they complained that it was objectionable.

By Mr. GATCHELL:

Q. Major Putnam said that a decrease in the stage at the head of Marmet pool for not more than two hours at a rate not to exceed 1½ feet an hour would not have any effect on navigation, adverse or otherwise, as long as the project level was maintained. Can you tell us what effect you have observed upon navigation in the Marmet pool, where the elevation—in decrease—where the elevation of the project pool was not—where the normal pool elevation was not reached?

By Mr. JACKSON. That is not an accurate quotation of Major Putnam's statement. The answer was this: (Referring to record and reading:)

"A. The rate of change in stage would have no effect on navigation, adverse or otherwise, except the necessary adjustments to lines and spars where boats are tied up at the terminals, so long as this rate did not continue to a point where the pool was no longer maintained at its project elevation."

By Mr. GATCHELL:

Q. What would you say about that?

A. The lock-master at London lock has received complaint that I have heard about.

2814 Q. Did you have any such yourself?

A. No, sir; I did not observe the conditions.

Q. Do you report all complaints to Mr. Carpenter?

A. All that I do not have authority to correct.

Q. Do you keep a record of complaints?

A. No, sir.

Q. Have you received any complaints regarding boats tied up at tipples?

A. Yes, sir.

Q. What is the nature of those?

A. Below Marmet Dam or Lock 6 pool, about four miles below Marmet, there is a coal tipple that has made several complaints of the lowering of the pool.

A. Boats going aground due to a falling river or lowering the stage at that point.

Q. Do you know if any such groundings were caused by fluctuations from Marmet and London power plant operations?

A. The Marmet——

By Mr. JACKSON (interrupting.) From his own observation?

By Mr. GATCHELL. I asked him if he knew.

A. I know that the lower pool at Marmet Dam fluctuated due to the operation of the hydro plant and, since this point is about four miles below, it is evidently the cause of their grounding.

Q. Did you receive many complaints or do you?

A. Yes; I did only recently. I might add that, since then, we
ported to the men that complained that we have no jurisdiction
er the control of this pool, and rather than report to me, they
to my superiors.

By Mr. JACKSON:

Q. You say "we"; where?
A. At Marmet.
Q. You refer to pool No. 6?
A. Yes, sir.

By Mr. GATCHELL. You may cross examine him.

By Mr. JACKSON. I move to strike the evidence of this
itness before the cross examination on the ground that it is not
roper rebuttal evidence.

By the COURT. I will strike it all except the latter part—that
knows that fluctuations were caused in pool No. 6 by discharges
om the Marmet power plant and caused one grounding.

By Mr. JACKSON. That is pool No. 6?
By the COURT. Yes, sir.

Cross-examination by Mr. JACKSON:

Q. How old are you?
A. I am 34 years old.
Q. How long have you been working for the Government?
A. Since 1929.
Q. You have been working there as lock-master for that period?
A. For the last two years.
Q. Before that, what was the nature of your work?
A. I was inspector of construction at the lock and dam.
Q. Before you went with the Government, where did you work?
A. I worked on surveys.
Q. Surveys on the river?
A. Yes, sir.
Q. For whom?
A. For the Government.
Q. You worked for the Government before 1929, did you?
A. No, sir; that was since then.
Q. What did you do before 1929?
A. I worked for the Commissioners of Sewerage at Louisville,
Kentucky—a survey man.
Q. Do you have any written instructions from your superiors
as to the operation of Marmet lock?
A. Yes, sir.
Q. Do you have them here with you?
A. No, sir.
Q. Do you have them here in the city?
A. No, sir.

Q. Can you have them sent here tomorrow?
A. I could write for them.
Q. Where would you have to send?
A. To Marmet Dam, at Marmet, West Virginia.
Q. Now, does the water ever flow over the roller gates at Marmet?
A. Yes, sir.
Q. It does that from time to time, does it?
A. Yes, sir.
Q. And at times it flows over the gates to a total of several tenths of a foot?
A. It has gone 0.2, I know.
Q. Hasn't it run higher than that at times?
A. I don't recall.
2816 Q. You have a gage there, haven't you?
A. Yes, sir.
Q. Is that an ordinary recording gage?
A. No, sir; it is a staff gage.
Q. You read it every hour?
A. Yes, sir; every hour.
Q. There is also an automatic recording gage, isn't there?
A. There is not on our property.
Q. But there is at the dam, isn't there?
A. The hydro plant, I understand, has one working.
Q. And that records the fluctuations in stage more accurately than a staff gage, read once an hour?
A. Yes, sir; it should if it is working properly.
Q. It does away with both the fact that the reading is intermittent of the staff gage and also does away with any possible errors in reading?
A. Yes, sir.
Q. The occasional overtopping of the gates is not merely a splash or spill, but it is an actual overflowing?
A. Yes, sir.
Q. Is there some question involved of flowage rights, if the water gets much over the top of the gates?
A. When the water goes over the top of the gates, it is due to mismanagement or fluctuations, but we attempt to keep it below and operate in normal times to keep the water below the top or at the top.
Q. But every once in a while, it does get over?
A. Due to mismanagement, I suppose.
Q. Would you say that it had been over the gates as often as 32 times in the month of July, by not less than 0.1 of a foot?
A. Well, it might have done that; it might have done that.
2817 Q. You testified about a complaint at a landing in pool No. 6; is that right?

A. Yes, sir.
Q. What landing was that?
A. That was the Hatfield-Campbell Creek Coal Company.
Q. Do you know what depth of water prevails in the landing r the harbor of the Hatfield-Campbell Creek Coal Company.
A. No, sir.
Q. Do you know to what depth the barges were loaded at the ime of the alleged grounding, if any?
A. No, sir.
Q. You know it to be a fact that Pool No. 6 was above the normal ool level at the time of the alleged grounding?
A. Yes, sir; it was.
Q. Isn't it a fact that, since Marmet Power Station has been in peration, the elevation of pool No. 6 below your dam has never een below the project elevation?
A. That is true.
Q. Mr. Castle testified here that, in accordance with a certain etter offered in evidence by the Government, in Exhibit 263, written by Colonel Conklin, there was permitted an increase in discharge of the Marmet Power Station at the rate of 3,000 second feet in an hour. Can you tell me how much an increase in discharge of 3,000 second feet in an hour would raise the elevation of the water at the tail race below Marmet Dam or at the upper end of Pool 6?
A. I have no knowledge of the discharge in second feet through Marmet Dam. We always tell in vertical heights.
Q. At Marmet Power Station?
A. Marmet Station.
Q. Don't you know that the full discharge or capacity discharge of the Marmet Power Station, that is, 9,000 or 10,000 second
2818 feet would increase the water elevation in the tail race below Marmet Dam and at the head of Pool No. 6 by about three feet?
A. Possibly, I don't know.
Q. Haven't you observed that?
A. That is, with the power company's turbines running wide open?

By Mr. JACKSON:

Q. Yes, sir, and nothing through the dam?
A. Possibly three feet.
Q. And wouldn't it be true that an increase in discharge of 3,000 second feet an hour would raise it approximately one foot per hour?
A. Something near that.
Q. Now, you said that an increase in stage of 1½ feet an hour that you would prepare to operate the roller gates?

A. Yes, sir; we would be prepared.

Q. The roller gates are operated by electricity, are they?

A. Yes, sir.

Q. And to operate them, you press a button and they raise?

A. Yes, sir.

Q. And the reason you would prepare to open them, would be so that you would let the water go over the crest of the dam, rather than spilling over the roller gates?

A. It would go out under the dam instead of over the crest.

Q. I thought it would go under the roller gates, but over the crest of the dam?

A. No, sir; it does not go over the crest of the dam, because we raise the rollers so the water will go under the rollers.

Q. The dam is a masonry dam, with the roller gates on top?

A. Yes, sir.

Q. And the roller gates simply increase the height of the dam or the masonry part of the dam?

A. Of the masonry part; yes, sir.

Q. And when you raise the roller gates, the water passes under them and over the masonry part of the dam?

2819 A. It passes over the sill of the dam, the sill; yes, sir.

By the COURT:

Q. What about the sill—how high is the sill referred to from the bottom of the gate, or the bottom of the river?

A. The elevation of the sill is 564 and the elevation of the apron below the dam is 550; it would be about 14 feet.

By Mr. JACKSON:

Q. If there is more water needed in pool No. 6, and the power station were not operating, you would have to raise the roller gates?

A. If we had the water, we would.

Q. Isn't it a fact that you didn't operate the roller gates but once in August?

A. In August, I believe that is right; it would not be over two times, I don't think.

Q. Isn't it a fact that you only operated it once on August 15th, for 13 minutes and you raised it about 3 inches?

A. I think that is right and I saw that—I was looking at it.

Q. Wasn't that operation because the water was over-topping the gates?

A. Yes, sir; that is right.

Q. Did you operate the gates more than two or three times in July?

A. I don't recall the number of times.

Q. You testified that at one time you asked some operater to djust the discharge and he refused?
A. Yes, sir.
Q. State when that was.
A. I don't recall the date; however, the operator, or the man ext to him, in responsibility, would know, because I talked to all of them about it.
2820 Q. Who was it you asked?
A. I tried to find out about that, but I could not find out bout it. He is stationed at Cabin Creek.
Q. I thought you asked the operator at Marmet to change?
A. I did.
Q. Who was that?
A. The operator, was named, I believe, Smith.
Q. Do you know when that was?
A. I don't recall the date.
Q. Was there any other occasion when you asked the operator o change the discharge?
A. One other time I asked him and he said he could not do it.
Q. When was it?
A. In the last two months. I don't know the date.
Q. Who was it you asked?
A. The operator on duty at the time. That was one of the easons we raised the roller sufficiently.
Q. What was the date?
A. I don't recall the date.
Q. How long ago was that?
A. It has been about two months, I will say.
Q. Isn't it a fact that you did not raise the rollers on any dates, except within the last three months—except July 6th, July 8th, and July 13th, and August 15th?
A. I don't know the dates. I will have to look at the records.
Q. Can you fix a date when you claim these conversations occurred?
A. No, sir.
Q. Do you live at Marmet Lock and Dam?
A. Yes, sir.
Q. Does the operator at the station—the power station work there?
A. He works at the Marmet Hydro plant.
2821 Q. And you don't know who they were?
A. I know Smith and I know one or two of them.
Q. Do you know who you were talking to on the second occasion?
A. No, sir.

Q. Can you refer to your records and tell us who it was?
A. No, sir; I don't have any record of that.
Q. Can you tell the date by looking at your records?
A. No, sir; I could probably guess when it was. It was one of three days that we operated the dam; it was one of those days.
Q. And you could only guess as to one of those days?
A. Yes, sir; Mr. McCormack was out of town at the time and you might trace it through that.
Q. Because he was out of town?
A. Yes, sir. I discussed it with him some time later.
Q. Why did you want the discharge changed?
A. I have instructions to do all I can to keep the water from going over the dam.
Q. And you wanted to increase it?
A. I wanted to increase it to draw it down.
Q. The pool was too high and you wanted more discharge?
A. Yes, sir.
Q. Was that the same situation on the other occasions?
A. The pool being high?
Q. Yes?
A. Yes.
Q. You could remedy that by pressing the button, couldn't you and raising the roller gates, or one of them?
A. Yes, sir.
Q. Why didn't you want to do that?
A. Instead of calling the hydro plant?
Q. Yes?
A. Because we wanted them to have as much water as they could get.
2822 Q. Then you were not offended that they didn't take it. It made no difference to you, did it?
A. No, sir; but they were supposed to do it. They were operating on a schedule and the operator at Marmet hydro plant said he could not change it without orders, and Cabin Creek Station told him to let it go as it was.
Q. So you then operated the roller gates?
A. Yes, sir.
Q. How many?
A. One.
Q. For how long?
A. For a very short time, 15 minutes, probably.
Q. Your trouble was remedied by opening the roller gates for 15 minutes?
A. For the time; yes, sir.
Q. How high did you open the gates?
A. I think about 6 inches, or 3 inches.

Q. What is the full opening of that gate?
A. About 50 feet.
Q. Is it that h'ight?
A. Yes, sir.
Q. Someone said it was 26.
A. The full opening of the gate?
Q. Yes?
A. You can raise the roller up 50 feet above the sill.
By the COURT. What is the diameter of the roller?
A. The diameter of the cylinder is 19 feet and 4 inches and it has a lip sticking down to take up the difference.

By Mr. JACKSON:

Q. You gave some testimony as to what would be the effect upon navigation in Marmet Pool which would result from
2823 a decrease in stage at the head of Marmet pool for not more than two hours at a rate not exceeding 1½ feet per hour. Now, assuming that the pool never fell below project level, what would be the effect on navigation in that pool, if any.
A. The lowering of the stage would affect it to a certain extent.
Q. If it was never lowered below project elevation, would it make any difference?
A. Yes, sir; if boats were not in the channel, it would make some difference.
Q. Your answer was based on the assumption that, if the boats were out of the channel, in the shallow part of the pool, the lowering might affect it?
A. No, sir; not affect them in the channel.
Q. How would it affect a boat in the channel at Marmet pool, if the stage never fell below project depth?
A. As I understand navigation—I am not a navigator, they will swing their tow boat around in order to keep a loaded tow in the channel, and by them having the tow boat out of the channel and the tow in the channel, they could easily have water drop in and they could hit an obstruction.
Q. Is it your testimony that the Government channel is not wide enough for navigation of a tow boat and the tow?
A. No, sir.
Q. (Continuing.) When it is full?
A. No, sir; I am not a navigator, but they complained.
Q. You hear lots of people complain about lots of things, don't you?
A. They do on that river.
Q. You had nothing to do with the design of the navigation channel, did you?
A. No, sir.

2824 Q. You don't mean to tell the Court that the navigation channel was so designed that that project, at normal elevation, is not suitable for navigation of a tow boat and tow, do you?

A. It is no doubt suitable; however, the operators are taking advantage of some of the conditions on the river and they may be mislead by the river falling—it may be dangerous.

Q. You are assuming in your answer that there is going to be a shortage of water because the boats are out of the channel.

A. Because the river is falling.

Q. If they are in the channel, you don't claim there is a shortage of water with project depth, do you?

A. No, sir; not in the channel.

Q. So you are answering upon the assumption that the boats are out of the channel?

A. They could be.

Q. That is the basis of your answer?

A. If part of them is out; yes, sir.

Q. Do you think a decrease of a foot and a half in stage would reduce the currents in Marmet pool or not?

A. It would do that to a certain extent, I believe; however, it is the falling water they have trouble with.

Q. Do you think the decrease of currents would be beneficial or otherwise?

A. The decrease in currents will usually be beneficial.

Q. I think you said that most of these troubles, so far as you heard about them, were at the upper end of the pool?

A. In the Marmet pool?

Q. Yes; I am talking about the Marmet pool, and that is where the old pool No. 3 was?

A. New No. 3?

2825 Q. No; old pool No. 3.

A. That is three miles below new Number 3.

Q. You mean that new No. 3 is London?

A. Yes, sir.

Q. Do you know that the elevation of old Pool No. 3 was 1.57 feet above the elevation of Marmet?

A. Yes, sir; approximately that; I don't remember the figures.

Q. And that old Dam No. 3 was taken out after the construction of Marmet pool, which dropped the water level up in that area by 1.57 feet?

A. Approximately; yes, sir.

Q. That drop was felt all through the shallow parts of the pool outside the channel and by landings that had been built, or were being maintained under the old conditions, wasn't it?

A. Yes, sir.

By Mr. JACKSON. That is all.

By Mr. GATCHELL. I may be laboring under a misapprehension. May I ask if Your Honor's ruling struck out the direct testimony.

By the COURT. My ruling did not apply to all of the evidence of this witness, but that portion that you asked about the grounding and pool No. 6. I said it was all stricken except so far as the witness says it was of his own knowledge—that he knew of one grounding, and that they were from fluctuations caused by the discharge from power operations at Marmet.

By Mr. GATCHELL:

Q. Where is the upper staff gage located at Marmet Dam?

A. It is located about 60 feet above the upper gate or the intermediate wall.

Q. Where is it located with respect to the power house—on the same bank?

A. It is on the opposite side of the river.

2826 Q. Where is the lower gage?

A. It is about 40 feet below the lower gates or intermediate wall.

Q. On which side of the river with respect to the power plant?

A. On the opposite side.

By the COURT:

Q. Since you have been there at Marmet, has the river gotten so high that the flow could not be taken care of through the gates?

A. Yes, sir.

Q. Has it ever gone over the top of the dam?

A. We raise the dam out of the way. It has gone over the top wall, which is five-foot higher than the elevation of the crest of the dam.

Q. You raise your gates when the flow gets high?

A. Yes, sir.

Q. Has the flow in the river gotten so high, since you have been there, that it could not be taken care of through the raised gate?

A. Yes, sir; we would have no control over it; the rollers would be all out of the water.

By Mr. GATCHELL. Q. Would it go over the roller gates when they were raised?

By the COURT:

He raised the gates—he raised the rollers and the discharge comes from the opening made by the raised rollers.

A. Yes, sir.

Q. Has the water gotten so high, since you have been there, that the discharge could not be taken care of in that way alone, and went over the whole thing?

A. Possibly it did during the ice last winter when it broke up and came down so fast it might have gone over just a little bit. That was in the break of the gorge, and I think
2827 we had a raise in the lower pool of five feet an hour.

Q. These gates are in between sort of pillars in sections?

A. Yes, sir.

Q. And it is a permanent structure that goes clear to the top?

A. Yes, sir.

2828 THOMAS H. GRAHAM

Direct examination by Mr. THOMPSON:

Q. Mr. Graham, will you please state your name and residence?

A. My name is Thomas H. Graham.

Q. What is your occupation?

A. I am employed by United States Engineers at Huntington, West Virginia, as Assistant to the Chief of the Repair Section.

Q. Where is Wicket Dam No. 6 on the Kanawha located?

A. About five miles below Charleston, and it is the next wicket dam below the City of Charleston.

Q. Do you know where Elk River discharges into the Kanawha?

A. I do.

Q. Where?

A. In the City of Charleston.

Q. What is the normal elevation of the pool above Wicket Dam No. 6?

A. Elevation 563.15.

Q. How far up Elk River does pool No. 6 back the water?

A. About three and a half miles.

Q. State whether or not Wicket Dam No. 6 will be eliminated by the construction of the Winfield dam?

A. It will.

Q. What will be the normal elevation of the pool created by the Winfield dam?

A. Elevation 566 above mean sea level.

Q. How far, if you know, will the Winfield pool back the water up Elk Creek?

A. About eight miles.

Q. Have you made any investigation to ascertain the source, or sources, from which the City of Charleston obtains its water supply?

Mr. JACKSON. I object as irrelevant and immaterial.

The COURT. He may answer.

Mr. JACKSON:

Exception.

A. I have.

2829 By Mr. THOMPSON:

Q. When?

A. Last month—August 31, 1936.

Q. Where does the City of Charleston obtain its water supply?

A. One plant is located on the west bank of the Elk River about one mile above the mouth of the river; the intake is in Elk River. Another plant is located on the left bank of the Kanawha River about 200 feet above the south side highway bridge; its intake is in the Kanawha River, and it is connected to the main plant by a water main running under the bed of the river. Another plant——

Mr. JACKSON: (Interposing.) Did you say "plant?"

A. Pumping station. A pumping station is located on the right bank of the Elk River about four and a half miles above the mouth of the river. This station is connected to the main plant by a water main.

By Mr. THOMPSON:

Q. Now, you have named three or four there?

A. Three.

Q. Are there any others?

A. There are two more.

Q. Where are they?

A. One above the City of Charleston, at Belle, West Virginia, and another at Nitro, below Charleston. Both are on the right bank of the Kanawha River, and have their intakes in the Kanawha River. These two plants are connected by water main running through the City of Charleston, which connect with the City Water Works, so Charleston may obtain water from either of these plants.

Q. State, if you know, when the river is low (that is Elk River) where does the City of Charleston get its water from?

A. During very dry seasons, all, or practically all, of the water for the City of Charleston comes from the Kanawha River.

2830 By Mr. THOMPSON:

Q. How low does the Elk River get, if you know, in flow?

A. It has been down to one second-feet.

Q. Do you recall what year that was?

A. 1930.

Q. State whether or not these pumping stations have a connecting system?

A. They do.

2831 At this point the following Government Exhibits were introduced by Huston Thompson, Attorney for the Plaintiffs

Government's Exhibit No. 264–A—Aerial photographs of New River from Hinton, W. Va., to Narrows, Va.

Government's Exhibit No. 264–B—Aerial photographs of New River from Hinton, W. Va., to Narrows, Va.

Government's Exhibit No. 264–C—Aerial photographs of New River from Hinton, W. Va., to Narrows, Va.

The following stipulation was entered into by the Counsel regarding the above Exhibits:

By Mr. JACKSON:

The waiver of objection to the admission of these Mosaic photographs produced is conditioned upon:

(1) Stipulation they were taken from a height of 10,000 feet or more;

(2) That all of the ink markings will be removed from the photographs, and

(3) That it is stipulated that the flow of the river at the time the pictures were taken ranged from 2,800 second-feet for a few of them, to 11,500 second-feet.

Is that agreed to?

By Mr. THOMPSON:

Yes, except I think the stipulation should be an average of 7,500 second-feet.

By Mr. JACKSON:

All right.

By Mr. THOMPSON. May we put these in as they are, and we will secure similar pictures, identical pictures, and substitute in place of these?

By the COURT. I think so.

By Mr. THOMPSON. Then we offer these in evidence as Government Exhibit Nos. 264–a–b–c. (Pictures were so marked by the reporter.)

By Mr. JACKSON. Subject to the stipulation and understanding the lettering on these exhibits now actually in Court are not received, and the exhibits present will be replaced by identical photographs, without such lettering.

By Mr. THOMPSON. Yes, sir.

2832 ROGER B. MCWHORTER, a witness hereto introduced by the United States, was recalled and testified as follows, on direct examination.

By Mr. THOMPSON. Q. Mr. McWhorter, on page 5261 of the record, Major Putnam states that in his opinion New River was not

susceptible of navigation in its natural state; please state your opinion on this subject?

By Mr. JACKSON. Objection to that as not proper rebuttal.

(Discussion by counsel.)

By Mr. JACKSON. It seems to me the most they could ask would be they be permitted to ask the single question that was submitted to Major Putnam and Colonel Watkins, and for the witness to answer yes or no.

By Mr. THOMPSON. I will ask the question and give it exactly as it is here.

Q. Will you state whether or not, in your opinion, New River was susceptible of navigation in its natural state?

By Mr. JACKSON. We want our exception noted because not proper rebuttal and not competent. The answer I understand is to be yes or no.

By Mr. THOMPSON. Your witness expressed a view that took one quarter of a page.

By Mr. JACKSON. I asked the reasons. You could have done so on direct.

A. It is, for the reason (interrupted).

By Mr. JACKSON. I object to him going any farther than giving his statement.

By the COURT:

That is all. He has given his reasons before.

Q. Mr. McWhorter, your attention is called to page 5290 and 5291 of the record, whereon Major Putnam says, in substance, a change in stage of five feet up or down at the rate of two feet
2833 per hour would not affect the mooring, loading and unloading of barges, the question reads:

"Q. What, if any, practical effect would an increase in stage, at a rate not to exceed two feet per hour, with a total rise in stage, not exceeding five feet, have upon the mooring, loading and unloading of barges or other vessels in harbors or at terminals along the Kanawha River.

"A. I understand there is a total limitation or another limit placed on the total amount of change and that is placed at five feet. That being the case, the only effect on navigation under those conditions would be that the barge men would have to keep their eyes open more actively so that on a decreasing stage their lines would not part, and on a rising stage they could take in their lines, and whichever direction the stage was going they could properly adjust any spars they used for keeping their barges off the banks.

"Q. You referred to rising and falling stages. I think I only asked about rising stages. Is your answer applicable to either

rising or falling stages at the rate of two feet per hour with a maximum change of five feet?.

"A. Yes, it is."

What do you have to say to that?

By Mr. JACKSON. I object to the form of the question and also to the competency of the witness to answer. He has never shown any experience in navigating boats.

By the COURT. I think he may answer it.

By Mr. JACKSON. Exception noted.

A. It is my opinion that any such great change as that in the stages of the river would very seriously and adversely affect the interests of navigation. In fact, I think under no condition could navigation thrive under such conditions.

By Mr. JACKSON. I move to strike that out. The conclusion that it would affect the interests of navigation is purely a conclusion of the witness.

By the COURT. Is that all you want on that?

By Mr. THOMPSON. Yes, Your Honor. He made a statement and I want him to explain why.

By Mr. JACKSON. Is our motion to strike rule on?

By the COURT. I will let it stay. He may ask him.

By Mr. JACKSON. May our exception be noted?

A. I was referring to those sudden and large changes in stage in a short period of time. The reason why that would affect navigation adversely is that boats could not be moored and sparred out and tied up and left for even as much as an hour or so without running the risk of having those boats break away from their moorings by the water being dropped from under them.

By Mr. THOMPSON:

Q. Mr. McWhorter, I have reference to page 5299 of Mr. Putnam's testimony. On that page Major Putnam states, in substance, that slack water navigation pools vary from 6 inches above and below the predetermined stage at which the pool is supposed
2834 to be maintained. What is your opinion as to whether such pools fluctuate in that manner?

A. They do not to my knowledge.

By Mr. JACKSON. I object to the competency of the witness to answer.

A. (Continuing.) They do not, to my knowledge, and there is no reason for it to fluctuate to those wide limits. In fact, these navigation pools can be and are held very close to the project levels.

By Mr. THOMPSON:

Q. I hand you, marked for identification, Defendant's Exhibit No. 525, consisting of fourteen pages and on the heading "War

Department, Office of the Division Engineer, Upper Mississippi Valley Division, Corps of Engineers, United States Army,"
2835 and dated St. Louis, Missouri, February 24, 1932, subject—Report on Application for License, Federal Power Project No. 1175, West Virginia, to the Chief of Engineers, U. S. Army, Washington, D. C., and ask you if you know what that is?

A. Yes, this is the report of the Division Engineer of the War Department at St. Louis, Missouri, who was the Commission's accredited field representative as to this project. This report was made pursuant to a request of the Federal Power Commission. It was made to the Chief of Engineers, and, pursuant thereto, the Chief of Engineers submitted his report to the Commission and this report of the Division Engineer I took from the Commission's files.

By Mr. THOMPSON:

Q. I call your attention to page 7 of that report, and ask you to read the 7th paragraph, entitled "Power Capacities."

A. "Power Capacities.—The average discharges of the Great Kanawha River for 90 percent of the time at Marmet and London were computed in office of the District Engineer, Huntington, West Virginia, from flow duration data based on 40 years of stream flow records at Lock #2, with proportional increases in flow due to increased drainage areas. To determine the net amount of water in second-feet available for power a deduction was made for water required for navigation lockages and for leakage through the lock, and crest gates. The resultant or residual flow remaining for power use for 90 percent of the time was found to be 2,660 second-feet at Marmet and 2,560 second-feet at London. This applies under present conditions of no storage in the basin. Using the formula for power capacity of h. p.=.08 q. h., where $q$ is the 90 percent power flow and $h$ is the average static head, the following table gives the flow values and power capacities to apply under the initial developments at Marmet and London.

"Stream flow 90 percent of time, second-feet, Marmet 2910, London 2800.

"Estimated available for power use, second-feet, Marmet, 2660, London 2560."

2836 Q. At that point will you subtract 2,660 fro 2,910 under Marmet?

By Mr. JACKSON. We will concede that 250 is the difference, but we object to the testimony. It isn't rebutting anything and he is reading from an exhibit in evidence.

By the COURT. He is trying to show what the representative of the Chief of Engineers, or the engineer in the field, allowed for lockage.

By Mr. THOMPSON. Yes, sir.

By the COURT. What is that in rebuttal of?

By Mr. THOMPSON. And to show that is the basis on which they figured the charges so far as operating those plants was concerned, and that that lockage of 250 second-feet is one which these people, the defendants, recognized, when they made their contract and it seems to me that rebuts any testimony that has been introduced here of some very minor low flow that is necessary for lockage.

By Mr. JACKSON. Will that affect the quantity of water actually used for lockages?

By the COURT. It only rebuts the answer of another engineer who says it is his opinion if I recollect correctly, from 150 to 200 second-feet, is sufficient for lockage.

By Mr. JACKSON. That is right. He made an engineering estimate. At the same time, he said it was true when they were trying to arrive at some trade or deal for this power that they discussed 250 second-feet as the outside limit that might some time or other, over this long term contract, be required for lockage, leakage and evaporation, and this doesn't rebut anything that is in the record.

By Mr. THOMPSON. I call Your Honor's attention to page 6446 of Mr. Scheidenhelm's cross-examination:

"Q. Wasn't an allowance made there of 250 second-feet for lockage upon which you computed your figures for the rental?

(Mr. Jackson objected.)

"The COURT. He may answer it.

"Mr. JACKSON. I don't think there is anything in the license about it at all.

"Mr. THOMPSON. I understood the Court to say 'any dispute.'

"The COURT. He can answer it unless there is some dispute about it and then we want the best evidence."

By the COURT. Did he answer it?

By Mr. THOMPSON. "Mr. Jackson. It is not in the license, and I understand it is not a fact.

"By Mr. THOMPSON. Our contention is when they figured the basis of the license, in all of the figures there was an allowance of 250 second-feet for lockage. That is what I am asking this witness, if that isn't true?

"By the COURT. You may answer.

"By Mr. JACKSON. May our exception be noted."

By Mr. JACKSON. Read the answer.

By Mr. THOMPSON. All right, I will read his answer, but you know how long his answers are: "There is, of course, no contractual arrangement in that respect at all. The fact is that when the economics of the problem were figured at the various

offices of the War Department, particularly at the District Office, there was an allowance for leakage and lockage made in the total of 200 or 250 second-feet, I do not recall which, an allowance in the sense that their estimate of total flow, volume of flow or rate of flow at any given time were reduced by 200 or 250 second-feet so as to reach a figure which they felt surely would represent"——

By the COURT. You are rebutting that testimony by bringing in a paper to show what the witness said is correct?

By Mr. THOMPSON. No, I am bringing this in to show here is an actual basis of 250 second-feet. They don't admit it. He said "200 or 250". I am bringing this evidence in as the best evidence to show that fact and that they recognized it.

By the COURT. I permitted it to be answered by the witness and he answered it and I don't think there is anything in this that is a denial of it at all.

By Mr. THOMPSON. The thing isn't settled by the answer of Mr. Scheidenhelm. It is in his usual language where he leaves a thing up in the air. Will Your Honor permit him to answer it?

By the COURT. I will permit him to say 250 feet, that it shows in the engineer's report that it was figured on the basis of 250 feet.

A. Your Honor, it shows more than that.

By Mr. JACKSON. I object to the witness—he doesn't want to wait for a question to start the argument.

By the COURT:

Q. What do you mean—it shows more than that?

A. It shows that Col. Scheidenhelm said that was the correct figure.

Q. The engineers' report doesn't show what Col. Scheidenhelm said?

A. No, but Col. Scheidenhelm submitted a memorandum commenting on that report in which he did make that statement.

By Mr. JACKSON. I object to the last statement and move to strike it out.

By Mr. THOMPSON. May I ask Counsel have you introduced a report from Mr. Scheidenhelm or Col. Scheidenhelm on the Kanawha Valley Power Company. I don't want to mark this for indentification if you have.

By Mr. JACKSON. No, I am sure we haven't introduced anything as irrelevant as that.

By Mr. THOMPSON:

Q. I hand you, marked for identification, Government Exhibit #266, being dated March 12, 1932, and in type form with the name of F. W. Scheidenhelm at the end, and being an informal

comment upon the report of the United States Division Engineer at St. Louis, February 24, 1932, on an application of the Kanawha Valley Power Company for license, Federal Power Project No. 1175, West Virginia, by F. W. Scheidenhelm, Consulting Engineer for Applicant, and ask you if you know what that is?

A. I do.

Q. Where did that come from?

A. From the files of the Federal Power Commission.

Q. Were you in the Federal Power Commission at the time that was received?

A. I was.

Q. Do you remember it being received there?

A. I do.

By Mr. THOMPSON. I offer this document in evidence.

By Mr. JACKSON. We object to it as not proper rebuttal and irrelevant and immaterial.

By the COURT. It may be a paper over Col. Scheidenhelm's signature that is contradictory of something he said.

By Mr. JACKSON. They can't do that without submitting it to him on the stand. I don't think one can lay in the bushes.

By the COURT. I was not thinking of that feature of it. Let me see what it is.

By Mr. THOMPSON. Your Honor will understand we have just introduced this document before which set up the figures of the Chief of Engineers and here is a comment by Mr. Scheidenhelm: "Par. 7. Power Capacity. In view of the estimates of flow and of the requirements for lockages and leakage as estimated by the Division Engineer, the derived figures in horse power appear to be correct."

By the COURT. I don't think that is contradictory of anything.

By Mr. THOMPSON. I think it is supporting. I want to make definite now what Mr. Scheidenhelm, as I say, has left up in the air, that is, this 250 second-feet.

By Mr. JACKSON. I object to the exhibit as not proper rebuttal.

By the COURT. Let it stay in.

By Mr. JACKSON. Exception noted.

2837 By Mr. THOMPSON. Q. On page 5770: "Q. Now assuming that for some reason the three-foot draw down between elevations 611 and 614 in the case of the London Pondage would not be available for reregulating any Radford power tides which might pass Kanawha Falls, and that no reregulation of these tides had been accomplished in any pond or reservoir upstream from the head of the London Pool, and assuming the Winfield and Gallipolis dams to have been completed and placed in operation. What, in your opinion, or rather what is your opinion as to whether any Radford Power tide passing Kanawha Falls

would be transmitted unchanged through the Kanawha navigation pools into the Ohio River, downstream from the Gallipolis dam? A. I think it is improbable that these waves would be transmitted down those navigation dams. The surface area is very large, so large that variation in water level of about two inches in those pools would be sufficient to reregulate the power waves from the Radford plant." I will stop long enough to ask the witness if he agrees with that statement?

By Mr. JACKSON. I object to that as not a proper method of rebuttal. We go through a record and read every question and answer and ask the witness if he agrees with it.

By Mr. THOMPSON. We are not reading one in a hundred. We are reading inconsistent statements.

By the COURT. It is expected that the witness will testify to the contrary?

By Mr. THOMPSON. He will testify to the contrary of that, absolutely. Then we will turn back, as soon as he gets through with that, to the next one and read the two that Your Honor has ruled out, and show there is an absolute inconsistency on the part of this witness.

By Mr. JACKSON. Won't that appear in the record?

By the COURT. I will let him answer this question. I don't think the proper way to ask the witness a question is to ask him if he agrees with it. The question ought to be more specific.

By Mr. THOMPSON:

Q. What do you have to say about it?

By Mr. JACKSON. I object to that as worse.

By the COURT. It is right difficult to frame a specific question and embody those conditions. I will let him answer it.

A. If the London pool were held at its maximum level of 614, the power waves reaching that pool from the Radford project would be transmitted practically unchanged through that pool, the Marmet pool, the Winfield pool and the Gallipolis pool, into the Ohio River, below the Gallipolis pool, and, in fact, they might reach the Ohio River below the Gallipolis dam as larger waves than they were when they reached the London pool for the reason that those pools are just as likely to be above the project level as they are below, and if they are above, these Radford waves would entrain that extra water and carry it on down to the Ohio River below the Gallipolis dam and thus cause larger waves than the Radford waves were at the London pool. Likewise, if the several pools on the Kanawha River, and the Gallipolis pool on the Ohio River should be below the project level, that would aggravate the condition of the long troughs that

would be formed over the week ends, or for longer periods, that the Radford project might be closed down.

2838 By Mr. THOMPSON:

Q. I hand you, for identification, Government Exhibit No. 267, being a letter from John J. Kingman, Lt. Col. Corps of Engineers, and Chairman of the Federal Power Commission, Interior Department Building, Washington, D. C., dated September 17, 1932, and ask you if you know what that is?

A. That is a letter from Lt. Col. John J. Kingman, for the Chief of Engineers, dated September 17, 1932, in response to a telephone request from the office of the Federal Power Commission.

By Mr. THOMPSON. Q. Mr. McWhorter, I call your attention to the testimony of page 6283 on direct of Col. Scheidenhelm, wherein it says, in substance, that the fluctuations in flow caused by the London and Marmet power plants are so much greater than the power waves that would be caused by the Radford plant, that the Radford waves would not be recognizable below the London dam. State whether or not, in your opinion, that is a true statement?

By Mr. JACKSON. I object to that as not proper rebuttal. He is reading an answer to the witness and asking him if it is a true statement.

By the COURT. I think he may answer that. I don't know whether that was gone into in chief or not.

A. That is not a correct statement, if the London pool is held at its maximum elevation of 614. I think it is true if that 3 feet of pondage is used for power subject to the paramount right of navigation.

By Mr. THOMPSON:

Q. Did you say it was a true statement if the three feet were used for pondage?

A. It is not a true statement. Yes, I said it was a true statement if the three feet of draw-down is being used for pondage for power purposes, subject to the paramount right of navigation.

Q. If it isn't being used for draw-down, what then?

A. I have testified it is not a true statement.

Q. Why?

A. Because the London pool would then be fixed at elevation 614 and these power waves would pass through it unchanged, or substantially unchanged, as they would pass through all the other pools down to, and including, the Gallipolis pool.

By Mr. THOMPSON:

Q. On page 6295 of the record, Colonel Scheidenhelm
2839 testified, in substance, that the operation of the Radford project would substantially increase the low water flows in the Kanawha River. Do you agree with that statement?

By Mr. JACKSON. We object to the form of the question.

By the COURT. I do not recall that that was the subject matter of inquiry before. He can only answer on that supposition.

A. I agree it would increase the average low water flows, but would greatly reduce—unless the plant were properly operated—the minimum low water flows, which is a critical view from the viewpoint of navigation. For instance, in these dry years like 1925 and 1930, the operation of the Radford project would increase the natural low water flow at Radford—at the Radford Dam site—from about 600 second feet to about 1200 second feet, but it would reduce the minimum low water flow from the natural flow of about 600 second feet to down to zero flow.

By Mr. THOMPSON:

Q. At page 6303 of the record, Colonel Scheidenhelm says, in substance: That the Radford project would control floods in such a manner as to increase the head at the Marmet, London and Winfield power plants on the Kanawha River. In your opinion, is that a true statement?

By Mr. JACKSON. We object to that.

A. I don't think that there is any substance in that statement—no appreciable substance to it.

By Mr. THOMPSON:

Q. What do you mean by that?

A. It might very slightly increase the flood heights or slightly decrease the flood heights, but in either case, it would be difficult to ascertain the magnitude of such changes. What Colonel Scheidenhelm meant by increasing the head at London, was that the tail water would be reduced in elevation, by the fact that the flood waters would be held back at Radford. It is highly problematical whether the flood waters so held back would exceed the natural valley storage preempted by the reservoir, and if it did not exceed it, certainly the flood heights would not be reduced on the Kanawha River.

2840 Cross examination by Mr. JACKSON:

Q. Mr. McWhorter, how large a volume, in cubic second feet, would be represented by one inch on the reservoir of the London, Marmet, Winfield and Gallipolis pools?

A. I have not computed that, but it would be the same—substantially the same—for above the project as below.

By Mr. JACKSON:

Q. I do not care about that. I want you to tell me, if you can, what would be the volume, in second feet—or second feet days—required to raise the level of the London, Marmet, Winfield and Gallipolis pools one inch above normal pool levels?

2841 A. I don't know; at least, if I ever knew, I do not have the figures now.

By Mr. JACKSON:

Q. Do you know the area of the Gallipolis pool at project elevation?

A. I do not.

By Mr. JACKSON:

Q. Mr. McWhorter, the area of the London pool elevation at 614 is 910 acres. Take that down.

A. (The witness makes notes on paper.)

Q. The area of the Marmet pool at elevation 590 is 1,420 acres. The area of the Winfield pool at 566 elevation will be 3,700 acres. The area of the Gallipolis pool at elevation 538 will be 9,760 acres. Now, as an Engineer, tell me what volume of water, in the second foot day, will be required to raise the surface of those four pools one inch?

By Mr. THOMPSON:

Q. Do you understand that this means raising all pools simultaneously?

A. That is my understanding of his question.

By the WITNESS. What is it you are after?

By Mr. JACKSON:

Q. How much volume of water in second foot days it would take to raise the surface of all those four pools one inch?

A. It would take 660 second feet.

By Mr. JACKSON:

Q. What is that?

A. It is 660 second feet.

Q. It would be 660 second feet days, you mean?

A. Second feet for 24 hours. Right there—just a minute—get it straight as we go along. You assume——

Q. All I am asking you is that. I did not ask you to assume anything. Compute the volume of water it would take to raise those four pools one inch, when the elevations are at project level?

A. And you assume——

Q. I did not ask you——

By the WITNESS. You assume that one inch would be uni-
2842 form over the surface of all the pools, which is not true.

By Mr. JACKSON:

Q. I did not ask you that, Mr. McWhorter, did I?

A. I want your assumption.

Q. All that I asked you to do is to compute how much water—the volume of water that would be required to raise those four pools one inch above the project level of those four pools?

A. I made the computation, showing 660 second feet.

Q. Second feet day?

A. Right.

Q. And would it be right to say that two inches would be approximately twice that volume, on each of these pools?

A. Yes.

Q. And three would be three times?

A. Yes, approximately.

Q. Does water, when it enters a pool, tend to seek its level?

A. Yes, sir.

Q. I produce here a letter, dated July 28th, 1936, on the letterhead of the War Department, United States Engineers Office, Huntington, West Virginia, office, addressed to Colonel F. W. Scheidenhelm, and signed John F. Conklin, Lieutenant Colonel, Corps of Engineers, District Engineer, and ask to have it marked as an Exhibit for the Defendant.

(Said letter, exhibit 610, offered in evidence.)

By Mr. THOMPSON:

Q. When you said it would take 660 cubic feet days to raise the surface of the Marmet, London and Winfield pools——

A. Second feet days.

Q. Second feet days, to raise the surface of the London, Marmet and Winfield dams, one inch above the normal project elevation, did you mean by that to raise the three reservoirs simultaneously?

A. There are four of them, and I answered the question as a hypothetical question as a correct answer to the question Mr. Jackson asked. Of course, I assumed all four would be raised uniformly one inch over the entire aggregate area of the four reservoirs.

2843 By Mr. THOMPSON:

Q. I hand you, marked for identification, "United States Exhibit 271," and ask you to look at it, and say if you know what it is?

A. I do.

Q. What is it?

A. It is a copy of the protest of the Appalachian Electric Power Company against the application of the Town of Galax, Virginia, for a grant and loan from the Federal Government for the construction of a municipal electric hydro and Diesel engine power plant and distribution system.

Q. Have you ever seen this document before?

A. I have.

Q. When?

A. The Town of Galax made this application for a loan from the P. W. A. to the State organization of the P. W. A., at Charlottesville. That application was forwarded on to the Public Works Administration, at Washington, together with this protest of the Appalachian Electric Power Company.

The Public Works Administration referred the application, together with this protest, to the Federal Power Commission for examination and report.

At that time I had occasion to examine this protest.

Q. Whose name is printed at the end of page eight of this protest, "Brief of Appalachian Electric Power Company?"

2844 Who is it signed by?

A. It is signed "Appalachian Electric Power Company, by counsel, John S. Draper, Attorney."

(Exhibit 271 was offered in evidence over defendant's objection that the same was not proper rebuttal and was inadmissible.)

By Mr. THOMPSON:

Q. Where is the Town of Galax?

WITNESS. A. It is in the upper part of New River Valley. On the right band of the river, and some little distance from the river.

Q. How far above the Radford dam would you say it is?

A. I would say probably 65 miles. I am just making a rough estimate.

Q. How far would you say it is from the North Carolina boundary?

A. Perhaps ten miles or less—less than ten miles.

2845 L. H. WATKINS

Direct examination by Mr. THOMPSON:

Q. Colonel, referring to page 5702, the tests made by Professor Thomas on August 14 to 15, to determine the effect of power operation on the normal Marmet pool, the witness testified as follows: "I found that there were no seiches that could be attributed to the wave that we ran." Is that a true statement, in your opinion?

Mr. JACKSON. I object to the form of the question. I do not know that he is prepared to state whether it is a true statement.

The COURT. Go ahead.

Mr. JACKSON. Exception.

A. No. I think he may have overlooked certain factors in there and he did not properly interpret it.

By Mr. THOMPSON:

Q. Upon what do you base that statement?

A. I have here the chart that was furnished by Mr. Thomas to the engineer of the Power Commission, upon the request of the Assistant Attorney General, towards the close of his examination.

This chart shows the Kanawha Falls curve of hydrograph of the Kanawha Falls gage, the upper London gage, the lower London gage, the upper Marmet gage, and the lower Marmet gage, during these operations.

Now, these operations were made under very adverse conditions. In the first place, they were made during a period of low flow, very low flow, when any fluctuations which you could get were necessarily small.

The volume of the wave used in the test was small. It did not amount to a full draw-down from the London pool. It was less, therefore, than 2,600 acre feet.

Just before the test was begun, a sharp wave was sent by, and it was bound to affect the test.

During the test, blocks of power were not put in uniformly up and down, as you would expect the wave to run, and were horizontally taken in and out. These were bound to affect the tests.

Furthermore, during the operation, the crest of the pool at the Marmet dam was allowed to rise two-tenths of a foot. That was it was bound to affect the test.

Now, referring to——

Mr. JACKSON (interposing). None of this, so far, answers the question.

WITNESS. I will show it. Just wait a minute.

I have here Government Exhibit 117–A, which shows a rating curve for the upper end of the pool below the London dam.

2846 Examining this curve and considering the variations which would occur by the 3,200 cubic feet per second discharge for a discharge of 4,100 cubic feet per second, which he claimed that he used during this test, we find that we would expect a rise in the upper end of the pool of about three-tenths of a foot.

Examining the hydrograph for the upper end of London pool, we find it did rise to three-tenths of a foot, and it fell about three-tenths of a foot, but, during the operation, they permitted the crest of the dam at Marmet to rise two-tenths of a foot, and that rise took place during the falling stage of the Marmet dam.

Had the Marmet stage been kept level, it would unquestionably have fallen two-tenths of a foot further, or a total of five-tenths of a foot, so it does indicate, without doubt that this did obey the fundamental law of tipping the upper end of the pool up, and then to have it fall not only to the point of rest, but about an equal distance beyond.

Unfortunately, the fluctuations at Marmet were very small, and it is difficult to show conclusive results. However, in this test made by Mr. Thomas, we have the rating curve for the lower Marmet gage, which is the upper end of Dam No. 6.

This does furnish very interesting and very conclusive information.

Mr. JACKSON. I suggest that he answer the question.

WITNESS. Wait a minute, and I will be glad for you to question me all you want when I get through, and I hope you do.

Now, taking Government Exhibit 117-B—that is another one of these famous rating curves that called so much attention in this Court—take that for a discharge of 3,200 cubic feet per second, plus 4,100 cubic feet per second, we see that we should expect a rise of about 1.2 feet, and, according to my theory, it should fall not only to the point of rest but to a point about that distance beyond.

Now, let us examine the curve: During the operation we find that the upper end of the pool or dam of No. 6 raises about
2847 1.2 feet and that it fell about 1.75 feet. But during the operation, the crest of the dam, the water, rose almost a foot, and it fell again to about the point of rest.

Now, during the downward stage (that is from about 7 P. M. until 3 P. M. on August 15, a total period of twenty hours), we find that the force of gravity and the impulse of the wave entering the pool forced the upper surface of the pool down, not only to less than that indicated by the crest of the dam, but even below the indicated point of rest for 3200 cubic feet per second, and, at the end of the old stage, it was only about eight-tenths above the final point of rest.

Now, during this downward stage, the surface of the pool in Dam No. 6 became more and more horizontal during the last stages of the test, until finally it was only seventeen hundredths of a foot above the water at the crest of the dam.

Now, had the dam not risen, it would no doubt have fallen below the horizontal—it would unquestionably have fallen below the horizontal.

So then, during the whole of the 20 hour period, we find that the force of gravity and momentum of this wave entering the pool was forcing the water down and down and over the dam.

So, at the end, it was impossible for the lockkeepers of Dam No. 6 to get the wickets up in time to maintain the crest that they desired.

Now, throughout their argument, the defendant had used small waves. This one, for example, is less than 2600 acres. Had they used larger, such as those that occurred during average annual flow, they would secure greater results. Furthermore, they neglected the Saturday and Sunday Troughs from Radford, which caused by far the greater fluctuation in pools of this nature.

Mr. JACKSON. I move to strike out the testimony so far. The witness has not touched the simple question that was asked.

Mr. THOMPSON. He has, but you have not recognized it.

Mr. JACKSON. He has repeated his testimony.

Mr. THOMPSON. He has described a situation which went past you, just like this wave.

Mr. JACKSON. He was asked whether or not there were any seiches shown in the pool.

The COURT. What is the actual statement?

Mr. THOMPSON. The statement of the witness, Mr. Thomas, was: "I found that there were no seiches in that pool that could be attributed to the wave that we ran." I asked him if that is a true and correct statement.

The COURT. As I understand what the witness is saying, it is in effect not as to the truthfulness and accuracy of the test, but whether, under a wave of larger amplitude, that would not be true.

Mr. JACKSON. That is what he said.

WITNESS. No; I said that he misinterpreted these things.

By Mr. THOMPSON:

Q. Isn't it a fact that there was a seiche there, and he didn't know it?

A. Yes, that is exactly what did happen.

Mr. JACKSON. That is the first time that he has commented on the question.

Mr. THOMPSON. The number of pages that your witness took to answer, it takes some time to cover.

The COURT. I think the witness should confine the statement to a smaller compass if he is going to state there was a seiche there which Mr. Thomas did not recognize.

2848 Q. What is your conclusion as to that statement of Prof. Thomas, that there were no seiches in that pool that could be attributed to the wave they ran?

A. He misinterpreted the results.

Q. And there was a seiche?

A. There was. No question about there being seiches in the upper end of the pool, in dam #6, as big and broad as day from night.

By the COURT:

You mean shown on the chart?

A. Yes, Sir.

By the COURT:

Or conditions which must have made them?

A. Shown on the chart when properly interpreted.

Q. Referring to page 5744, in discussing the shape and decrease of power wave, the witness concludes; "In my opinion it would be impossible for waves released from a point as far upstream as

Radford to cause any perceptible seiche in these navigation pools". Colonel Watkins, is it possible to release waves from a point as far upstream as Radford and not cause any perceptible seiche in the navigation pools on the Kanawha?

A. The point is——[interrupted].

By Mr. JACKSON:

I object to the question as not proper rebuttal. Certainly if anyone expressed his opinion fully in the opening of the Government's case as to what he thought about waves, Colonel Watkins did.

A. Prof. Thomas on proof shows it.

By Mr. JACKSON. He is doing nothing but asking him to restate his evidence and opinion about it, merely because we offered testimony on the subject as to which they gave testimony in the main part of their case.

By the COURT:

What do you say to that, Mr. Thompson?

A. The Professor on tests proves the decrease in the waves——[interrupted].

By Mr. JACKSON:

I move to strike that out. Colonel Watkins you know Court procedure better than to be volunteering statements.

2849 A. The point at issue is the fact Prof. Thomas attempted to prove the decrease in the back end of the wave would be so long it would not affect these pools. Well his own test which he made just to show that purpose, shows it would greatly affect it. The reason for that is very simple. As I have explained a number of times in my examination and cross examination, that the fact which caused the fluctuation in these pools is when the wave enters it, causes it to tip up, then the force of gravity, plus the impulse, momentum of the large volume of wave entering the pool, causes it not only to sink to the point of rest, but about an equal distance beyond. He attempted to show if you prolonged the wave long enough it would cause no effect, whereas, as a matter of fact, the rate of decrease or increase, so long as it occurs in a single day, and so long as the volume and amplitude are the same, makes no appreciable difference in the effect. In the results he made, at dam #6, the wave fell about the same, although he intentionally prolonged it about twenty hours it made no difference whatever, he just simply made a fundamental error.

By Mr. JACKSON. I move to strike out the answer because the witness states what he previously stated and reiterated on direct.

By the COURT. The answer may remain in.

By Mr. JACKSON. Exception.

2850 By Mr. THOMPSON:

Q. Colonel, Professor Thomas stated on his direct examination that he studied by analytical methods and also by constructing what he called an integrating model of the Bluestone reservoir, with different vertical and longitudinal scales, and it was sensitive enough to detect seiches of about five one-hundredths of a foot or five-eighths of an inch, and he continued by saying, "I could not detect any perceptible seiche in the reservoir on this model, which checked my computation, which would show the height in Bluestone reservoir would be less than five hundredths of a foot." Colonel, why, in your opinion, couldn't he detect a seiche in the Bluestone that would be less than five hundredths of an inch on this model that he described?

A. I do not know why.

Q. You do not know why?

A. No.

Q. I do not understand the answer.

A. I don't know why because I have had a great deal of experience in supervising hydroelectric interests and navigation interests in navigable waterways in which this very factor was involved, and I found out in the experiments that when the wave enters the stream it did cause the upper end to tip up and to force the gravity and the momentum and a large volume of power or force over the surface of the pool, not only down through the point of rest but to an equal distance beyond. I was so sure of that I got up and testified in court that this would happen in the pools on the Kanawha River, knowing full well that the defendant, or its subsidiary, was operating power plants on the river above.

Q. You have read the testimony of Professor Thomas with respect to his integrating model, and how he operated it, and the results that he obtained, have you not?

A. Yes.

Q. What is wrong with his integrating model so far as the information or data upon which he constructed and operated it are concerned?

2851 A. I think he made—I know that he made two fundamental errors in adjusting his model.

Q. What were they?

A. One of those was the fact that he adjusted it to conform to the waves of the 1930 tests, and he adjusted it to conform to the amplitude rather than the volume. Now, looking at those waves, you can very readily realize that they are not going to maintain their persistency in altitude.

Q. Why not?

A. For the simple reason that the amplitude at which they were discharged from the Buck project was far too great for the volume. You could not expect such waves to persist like that.

Furthermore, he did not adjust it to the most persistent wave which anyone would readily understand would be more or less typical type of wave for the river.

In the third place, in another place in his testimony, he stated that he did not adjust his model to conform to the volume—he did not use the volume in testing it. I have had a great deal of experience in tracing waves of different forms, and especially downstream, by simply using the rating curve in the stream and constructing a flood channel, as inflow and outflow curve, and I have constructed waves of various forms actually thousands and thousands of miles. I do know if he adjusted his model without using volume for adjusting it, it will not give accurate results.

Q. And you say he did adjust it without using volume?

A. He stated it in his testimony.

Mr. JACKSON. Will you give me the reference to the page?

A. Will you give him that, Mr. Thompson? It is in the notes. One on the point is on page 5836. He uses these words: "I then ran tides down the model corresponding to the 1930 tides and checked the change in the profiles at those tides, and then adjusted the baffles between gaging stations so the model would reproduce the profile or hydrographs of the 1930 tides."

Then, again, on page 5855 of the manuscript, during his cross-examination, he answered about the 1930 tests, "I did not figure volume." Then the question, "Didn't you figure volume at all?" and he answered "I figured volume at various times in the study, but not for the purpose of adjusting the model."

By Mr. THOMPSON:

Q. Now, it is your contention that you cannot adjust a model of that kind unless you do figure volume?

A. Let us take a very simple thing: Anyone, even a layman, knows that the more the rain the higher the flood. The same thing applies to power waves coming downstream. And, furthermore, if you do not consider volume in adjusting, you have no absolute way of checking your results below.

2852 The volume I found in tracing waves downstream, if you use volume you can check your results all the way down the stream.

Q. You said there were two fundamental errors; you spoke of volume and then you spoke of using the data of the 1930 wave?

A. Yes.

Q. Wherein did the error lie in using the data of the 1930

A. As I have already explained, those waves were not of a shape and they were not discharged in a manner to possess any amplitude, and, in the second place, those waves had nothing to represent the Saturday and Sunday trough coming from Radford.

After all these successive waves, we know they are going to overlap and not persist permanently. On the other hand, the gap between the Friday wave and the Monday wave is so great that there will be no overlap, so that we may expect such a trough as that to go hundreds and hundreds of miles downstream and lose their amplitude between the crest of the week day wave and the trough of the Saturday wave.

By Mr. THOMPSON:

Q. Could the witness' conclusion be correct from the data and tests that he made, as testified to, that perceptible seiches could not be observed in the Bluestone reservoir from waves coming from the Radford project?

Mr. JACKSON. I object to the form of that question.

The COURT. I will let him answer it.

Mr. JACKSON. Exception.

A. May I have just a moment to think about it? These are technical engineering questions and asked in entirely different form, and I would like to think about it a second so I do not make a mistake. The methods of adjusting his model indicate that the results would not be wholly reliable. My own experience indicates that when a wave does enter the upper end of a pool it tips it up and falls about the same distance below. Mr. Thomas' own tests down on the Kanawha confirm that fact very conclusively.

The COURT (interposing). He just testified a moment ago with respect to these waves about which Mr. Thomas testified, while he did not say whether or not they would create seiches he said his tests were based on inaccurate data of the volume of the wave—that no such wave as that would in effect occur. I did not understand him, however, to deny presuming the waves used by Mr. Thomas in his tests were those which would actually take place; that statement of Mr. Thomas, or the conclusions of Mr. Thomas were inaccurate. He said his tests were based on inaccurate data, as I understand. Is that correct?

WITNESS. Yes, sir; and not consistent with what I have found out by experience.

By Mr. THOMPSON:

Q. Does that go to all types of waves?

A. To all types.

Q. I believe you have testified that it is not possible to properly adjust a model to determine persistency of waves without considering volume; is that right?

Mr. JACKSON. I object to the question as leading.

The COURT. He may answer it.

Mr. JACKSON. Exception.

A. I do not think you can get reliable results. You
2853 may by accident hit the adjustment, but I do not think that they will be reliable.

By Mr. THOMPSON:

Q. I call your attention to the testimony of Professor Thomas on page 5908:

"Q. Will you explain to the Court the principle of the integrating model?

"A. Such a model is a model of some hydraulic structure which does not resemble the structure closely physically, but satisfies the same mathematical equation. I think I can best explain the principle by using the chart."

Then there is a great deal of testimony with respect to the chart. Now, I want to ask you this question: Would this model, as described by the witness and as operated by him, give correct results so that he could apply an algebraic formula to it, if based upon the data which he says that he got from the 1930 wave tests?

A. His results, of course, would be in error if he makes mistakes in the adjustment.

Q. State whether or not there is any value of a mathematical formula or an algebraic formula, if that is what it was, applied to a model where the data upon which the model is adjusted does not include the various items which it should include to properly adjust it?

A. Oh, well, no doubt he included the items he should have included, but he used an improper basis for adjustment. I would like to state that in the formula itself that he shows is a very long and complicated thing. In an integrating model you can get wonderful results for current around dams and other flumes, and also current in river channels like the lower Mississippi, but when you come to measuring just the way a river will discharge a volume of water downstream, you have a very complex problem. If your model is not carefully constructed and not properly adjusted, you can't get reliable results. There are no two ways about it.

On the other hand, if it is carefully constructed to show close correspondence to the river and for each section downstream, and it has these baffles placed in it with points corresponding to the

very shoals and restricted to parts of the channel adjusted to conform to the actual obstruction and stream flow, and if
2854 it has in it every important thing, the channel storage corresponding to the channel storage downstream, and you adjust that model to discharge volumes downstream in a manner typical of the river, then you can undoubtedly get very good results.

Q. Did he have this model adjusted according to his statement as you understand it to these various items you have described?

A. I have stated he had two fundamental errors in there. There in his testimony he stated he did not attempt to locate the baffles at corresponding points of obstruction in the channel itself.

Q. So would or would there not be any virtue in applying a mathematical formula to an adjustment of that kind?

A. As I said it is very complex. The waves themselves are very complex, and if you make an error you will not get reliable results.

Q. You mean by error such error as you have described?

A. Yes, sir.

Q. On page 5925 and 5926, the witness stated: "In determining the percentage of reduction of waves, it is important to take into consideration a great many things, among them whether the wave occurs on a rising or falling stage of stream; whether the wave is a series or group of similar waves, or whether the adjacent waves are larger or smaller, whether there are minor wave summits between the main wave summit, all of those things enter into the question of what the reduction in amplitude and volume will be, and in the case of the 1930 wave series, we noted there was an enormous variation in the percentage of reduction and volume in the individual waves and those percentages depending on a variety of conditions which were present in that series." Please state whether or not Prof. Thomas could have obtained a reasonable estimate of the percentage of reduction of waves by considering the things he has here stated?

By Mr. JACKSON. I object to that question as not proper rebuttal.

By Mr. THOMPSON. He has stated the conditions——

By the COURT. He may answer.

A. It would be practical to make a reasonable estimate.

Q. Would that be practical without considering the question of volume?

A. No; you would have to consider volume. As an estimate for use in this problem I suggest we adopt the waves at

2855 Kanawha Falls, a volume of about 80% of that for the wave discharged at Radford. Now for each section of the river there is a more or less constant relation between the volume and the amplitude of the waves. If for the purpose of this problem we adopt [interrupted].

By Mr. JACKSON. I object to the answer. He has already answered the question.

By the COURT. He may complete his answer, but I don't want a long dissertation.

By Mr. THOMPSON. I have given the series of matters the witness thought important in determining the percentage of reduction of waves, and I asked if that could be done satisfactorily without considering volume.

By Mr. JACKSON. He has answered that.

By the COURT. I understood him to say no.

A. I have answered that.

Q. Referring to record, page 5356, the testimony of Mr. Putnam:

"Q. How did you arrive at this expenditure of $200,000,000; in other words, how many reservoirs did you figure on constructing?

"A. I figured an average lift of twenty feet at each dam, making roughly about 1,800 feet of fall, approximately 1,800 feet between the head of London pool and the mouth of Wilson. I mean to overcome that fall some 90 locks and dams would be required, with an average lift of twenty feet.

"Q. Why did you only make it twenty feet?

"A. Because, there were two reasons for that, in the first place I felt if I exceeded twenty feet in some locations we would get into difficulties with the railroads along the bank; in the second place there is from the point of view of improving a stream for navigation an economical limit, beyond which it is not wise to go on the question of lift, in other words, in attempting to save the number of dams."

Q. Please state whether or not, in your opinion, that is a feasible or reasonable way of developing navigation on New River.

By Mr. JACKSON. I object to the form of the question. I don't understand this procedure of reading a page from the transcript and then asking the witness a question.

By the COURT. Of course that is unusual, but this record is so large it is difficult to remember or keep track of what witnesses said exactly, and I am admitting it for that reason, and in an effort to expedite matters.

A. No; it is not a reasonable method.

Q. Why?

A. In the first place these low dams, only twenty feet, will be well below flood height along the river. They will be unable to

assist at all in flood control of the river, and if gates are installed and operated with fixed crest at the dam, like those on the lower river, this long series of dams would materially increase flood heights below, and in the second place the dams are so low that you could not economically develop power at these sites, and what you could develop would be flooded out during all floods.

Q. Would that be the best or even the practicable way of improving that river for navigation?

A. No.

Q. Why not?

2856 A. In the first place too many dams, no excuse for that many dams. It would simply be so low navigation would be absolutely flooded out during periods of flood. You have high floods on this river. And in the third place, you can't build dams in the river without affecting other interests, it is impossible to put them in without affecting other interests.

By the COURT. Isn't that exactly what the Government has down so far in its navigation dams, built them about twenty feet, about twenty-four at London and Winfield; isn't that exactly what the Government is doing, building a series of comparatively low dams to aid navigation on that river; do you criticise that?

By the WITNESS. There is a reason for that, that section of the river is built up with manufacturing plants and all sorts of things are along the river, so you can't get them higher than they are. I have asked the engineers why and they say you can't do it without flooding out all these interests.

By the COURT. Isn't that what Mr. Putnam said they ought to be, around twenty feet, what they are?

A. Up on the New River.

By the COURT. I didn't understand him to say extending all the way up the course of New River.

A. All the way to Wilson Creek on New River. I have made a study of the lay-out of possible projects all the way from the mouth, right to Wilson Creek, and I have taken into consideration the railroads and flood heights and all those factors, and I know you can lay-out a god system of projects without materially interfering with the railroad, except in places, and without flooding out any point in local centers, ranging in height from about forty feet to seventy-five feet. With higher dams such as Bluestone, Radford, etc., you can lay-out a good system of projects all the way up that will assist greatly in flood control, development of power, and all those things.

2857 Q. State if there isn't a difference in the gradient of the Kanawha River down where the Government dams are put and the gradient of the New River from the Kanawha Falls, or from the Gauley River up to Wilson Creek?

By Mr. JACKSON. We concede that.

A. Yes; the slope in the lower river is much flatter.

By the COURT:

Q. Col. Watkins, have you made an estimate of the cost of developing that river for navigation?

A. Yes, sir.

Q. What is your estimate of the cost for a 9-foot channel?

A. I don't recall now what it is. I can say that the combined development of the river for navigation, flood control, and power was a very attractive price. I don't recall the figures. It was some time ago. I haven't them with me.

By Mr. THOMPSON:

Q. Can you give an approximation of it?

A. I made a very detailed study of the river for all of the facts involved in it and I don't recall what the figures are now.

Q. Was it more or less than $200,000,000, if you can remember?

A. Well, it was a combined development. I didn't consider these low dams because, frankly, they are absurd when you talk about using them for the development of the river, and I don't recall what they combined but I do know that the economy of the development was unquestionably for power and you had excellent flood control and you could certainly expect in the future to economically develop through waterways or anything of that nature you wanted.

2858 Cross-examination by Mr. JACKSON:

Q. Col. Watkins, will you define an integrating model?

A. Mr. Thomas gave a very detailed description of it.

Q. You tell me. You define it briefly now so we will get through.

A. Well, an integrating model is a model that, in order to bring the proportion of the section of the river or other factor considered, within reasonable ranges, you foreshorten the total length and thereby you increase the slope, you modify the cross section of the volume and you do a great many things that are certainly not in the river itself, so in order to use that you have got to use a complex formula just like Mr. Thomas described. That, in my opinion, is a very good description of an integrating model. I don't say you can't get good results for certain things, but it is complex.

Q. Is it the application of analytical and mathematical methods to models?

A. Oh, yes; you can apply all sorts of formulas, empirical, or other formulas.

Q. You said it was a matter of adjusting. You mean it is a matter of scale?

A. No; I mean adjusting it so you get the right results, in measuring the persistency of waves. That is what he was trying to do.

Q. You spoke about foreshortening—what was it—the length?

A. You mean this integrating model?

Q. Yes.

A. Yes.

Q. In your understanding is that merely a matter of scale?

A. Well, if you foreshorten the length you are going to increase your slope and if you reduce the width you are
2859 going to affect the manner in which that remaining channel is going to discharge water and all sorts of factors. They can be corrected by formulas but they are empirical formulas.

Q. What I am getting at, do you mean that the matter of an integrating model is a mere matter of adjustment of scale?

A. Oh, no; you have got to do a whole lot more than that. You have got to make the slopes conform somewhat to those of various sections of the stream. You have got to put in baffles at the right point to go around and represent obstructions to the stream; you have got to go ahead and put in channel storage corresponding somewhat to the channel storage of the stream—I mean if you are going to measure the effect on waves.

Q. Your idea is that in an integrating mod[illegible]u just have the original on a reduced scale?

A. No; you have it on a distorted scale.

Q. But it is a mere matter of adjusting scales as related to the original; in your opinion?

A. No; it is not a mere matter of that. It is a mere matter of getting all the factors which affect the shapes and forms of waves as they go downstream. It is a complex problem.

Q. Do you understand that there is placed in the integrating model something to represent particular falls, for instance?

A. Yes; undoubtedly you can put them in there but Mr. Thomas said he didn't have anything in there that represents Sandstone.

Q. In your judgment, in an integrating model, should you have in the model something in the form of a baffle, or otherwise, that represents each particular falls or obstruction in the river?

A. I say there should be something to do that because if you group those baffles near a rating station it is going to cause successive waves that come along to run together at that point and help to dampen out their persistence. In other words, you don't keep them separated. If you group those baffles in place
2860 and don't locate them along the stream like they should be, you are going to make them run together and loose the persistency just as you would if you stick a whole lot of storage between those rating curves and, although it may measure one

rating curve all right, if you turn loose a series of successive waves down through there, that storage is just going to wipe them all out.

Q. Col. Watkins, we are trying to get through with it. If you don't mind answering my question and avoiding any long dissertation after it, it would help out a good deal.

By Mr. THOMPSON. I insist that the witness be permitted to answer.

By Mr. JACKSON:

Q. Did you understand that Prof. Thomas grouped his baffles in the way you have described?

A. He stated he located them along the rating curve, in his testimony. He stated he did not locate them along where the obstacles of the stream were.

Q. Is it your understanding that Prof. Thomas grouped his baffles near the gaging stations?

A. I don't care where he located them. I described where he located them. He spoke of setting them in there and he did say he didn't take any trouble to locate them.

Q. You don't know where they were located, do you?

A. No; I don't.

Q. Why do you say they were grouped below the gaging stations?

A. Because if he didn't locate them where the obstacles of the stream were he is not going to get correct results.

Q. Is it your idea in an integrating model, you have a baffle located just where each obstruction is in the original?

A. Yes; for the simple reason that if you don't you are going to ruin your waves. You are going to run the successive waves together.

Q. You don't have to argue with me if you will answer the question.

A. I want to make this emphatic. You are asking me these things——

By Mr. JACKSON:

Q. Col. Watkins, did you ever construct an integrating model?

A. No; I haven't—yes; I have too, but not exactly perfect—simply to get the effect of dams, other shapes of dams and
2861 currents that result therefrom. May I continue my answer?

I may say for determining the manner in which waves have gone downstream, I have gone to the stream itself, which is much better than using a model, and I have used simple rating curves and simple flood storage curves and used those as a yardstick and traced them right downstream with the very factors of the stream.

It is much better than simply using a model. That is why I haven't used them for tracing them downstream.

By Mr. JACKSON. I move to strike out the answer as not responsive.

By the COURT. Let it stay in.

Q. (The question was read as follows): Col. Watkins, did you ever construct an integrating model?

By Mr. JACKSON:

Q. Did you?

A. I have answered that.

Q. Say yes or no.

A. I said I have used models to help me and I went ahead and told you why I didn't use them more.

Q. Have you ever constructed an integrating model?

A. No; not according to the system of Mr. Thomas.

Q. To be perfectly frank, you have not; isn't that true?

A. In a small way it was, not according to his formula. I didn't have to go into all the detailed formulas for those kind of things.

Q. You never constructed an integrating model of the kind that Prof. Thomas was using, did you?

A. Not of the long detailed kind that he did, but simple models for determining stream flows about dams and those things.

Q. I am asking you about integrating models?

A. No; I didn't do it and I told you why I haven't, because I can get much better results as to these waves downstream in going to the stream itself.

By Mr. JACKSON. I move to strike out the last part of the answer as not responsive.

By the COURT. I will let it stand.

By Mr. JACKSON:

Q. The models that you used looked like the original except they were smaller, didn't they, or at least, intended to look like the originals?

A. Somewhat like it. In some cases it was simply sections of the stream instead of the whole stream to determine just
2862 the way the velocity of the current would run over a dam or something like that—very simple.

Q. And the more your models looked like the original, except in scale, and were like the original, the better they were, were they not?

A. Yes; the better they were, the more like the original they were, the better they were.

Q. In other words, you simply had a scale model of the original that you were studying, didn't you?

A. Approximately so.

Q. And not an integrating model; is that right?

A. I think that is more the case. There was some of the scale somewhat distorted, but not much.

Q. As you understand it, is distortion of scale the sole characteristic of an integrating model?

A. Oh, no; Mr. Thomas, I think, has explained in detail his model, and I don't think you need to go into it farther.

Q. The fact is you never knew what an integrating model was like until you read Mr. Thomas' description of it, did you?

A. I knew there were such models. I have never had any necessity to use them. I could always go to the stream itself and get my data which is much more reliable, so that I have not gone into it.

Q. You do know that the United States Engineering Office uses integrating models and has tests made in the laboratory of the Carnegie Institute of Technology, don't you?

A. Yes; I know that, certainly.

Q. They do that right along, don't they?

A. Yes; but those currents measured there are not waves coming downstream. I just said these waves are complex. These currents are simple.

Q. Don't you know that the United States Engineering Office now is having built an integrating model in the laboratory
2863 of the Carnegie Institute of Technology, for studying flood waves passing downstream?

A. No; I didn't know that.

Q. You didn't?

A. No.

Q. You haven't kept up on the matter of integrating models in the study of stream flow, have you?

A. But I do know that New River has plenty of gaging stations all the way up and downstream, and at its tributaries for you to go to the stream itself and measure the effect and the form and the shape in which waves will come downstream, with an accuracy depending solely upon your own computations and it will take in every physical characteristic of the stream all the way down from top to bottom.

Q. And did you, Col. Watkins, ever release a wave at Radford of the size and form that you are talking about and actually measure it at the gaging stations downstream on New River?

A. No; I didn't need to, not for the purposes of this problem, because my knowledge was good enough to let me get within a reasonable estimate of what would be the results just as those famous rating curves I constructed on the lower river do give the results down there. I can give you just about the same results

with these waves on this river so far as the factors of this problem are concerned.

Q. In other words, you were not able, were you, to turn out a full-size wave of the kind you were studying at Radford and actually measure its action passing down the river?

A. No; but my experience is that it wasn't necessary, not necessary with the experience I have had on this river. It was not necessary for me to go up there and make an estimate, which was good enough for all purposes of this problem, for the simple reason that the effects are so great that we don't have to get down to very close details, very fortunately.

Q. Whether you had to or not, you didn't do it?

2864 A. No; I didn't do it and I explained why I didn't do it.

Q. It wouldn't be possible to do it, would it, at the present time and under present conditions?

A. I may add, of course, Radford isn't there and I don't have to have it there to make an estimate.

Q. I understand you don't need any estimate, but I am trying to get at the facts you did have, if any. Col. Watkins, I want you to state briefly the precise error that you found in the adjustment of the integrating model by Prof. Thomas?

A. As I have already explained, one of them was due to the fact that, according to his statement, he adjusted the model to conform to the wave discharge by the 1930 tests. Now, those waves, on account of the form in which they were discharged, had a great loss in amplitude and, to a certain extent, in volume, and they had no Saturday trough, which, after all, is the most vital factor in this problem, and, in the second place, they were not adjusted according to the witness' statement, according to volume. He didn't consider volume. I have had enough experience to know well enough that you cannot get accurate results with any model if you do not make a discharge of volume downstream and the manner in which a typical wave of the stream goes down.

Q. I am only trying to get your errors and unless you are under compulsion, you don't need to argue each one as you state it. At the present time I understand you claim one error in adjustment; that is, that Prof. Thomas, in adjusting his integrating model, did not take into consideration the volume of the waves, of a 1930 wave; is that right?

A. He said he didn't consider volume in adjusting his machine.

Q. And you claim he did not consider volume in adjusting the integrating model?

A. I claim that he stated he didn't.

Q. That is one error you claim in adjustment; is that right?

2865 A. That is one of them.

Q. Do you claim any other error in adjustment of that integrating model, if so, what is it?

A. I claim he stated he adjusted it to conform to the 1930 waves of the 1930 test.

Q. Do you claim he didn't do it?

A. No; I don't, he said he did, and I say that was an error.

Q. You claim that data was not proper, but I am trying to find out what errors you claim Prof. Thomas made in the adjustment of his integrating model?

A. I think I have made that clear.

Q. Is there any other error you claim he made than your assertion that he did not take into consideration the volume of the waves in the 1930 wave tests?

A. His evidence indicated that he did not locate his baffles according to the position of the various obstacles that flow downstream.

Q. The second error that you claim is that the integrating model did not have a baffle corresponding to Sandstone falls and every other falls in the river or obstruction in the river; is that right?

A. If you are going to get perfect measurements of the persistency of a wave going downstream, you cannot neglect to put obstacles proportionately along which conform to those in real life, for the simple reason that if you don't locate them right and exhibit them, you are going to run the waves together and you are going to lose them.

Q. Are you talking now about an integrating model or a scale model?

A. Yes; I am talking about any kind of a model.

Q. Any kind of a model?

A. Yes, sir; any kind of a model.

Q. You make no distinction between an integrating model and a scale model in this respect?

2866 A. No.

Q. You still haven't answered my question. I am asking you for the second error that you claim in adjustment?

A. I have already told you two, and I have told you three. Look at the record.

Q. Wait a minute.

A. Don't try to confuse the issue. I have told you two positively and I told you this other baffled.

By Mr. JACKSON: I move to strike out the statement.

By Mr. JACKSON:

Q. You have told me that you allege one error in adjustment in failing to take into consideration the volume of the 1930 wave and

for the failure of the model to discharge volumes, failure to adjust the model to discharge volumes.

A. Failure to adjust the model to discharge volumes?

Q. Discharge volumes of what?

A. Water. He said he didn't take into consideration the volumes in adjusting his machine, he made an error.

Q. We will agree that you claim that is one error. Can we let that alone. The second error that you claim is that he didn't put baffles in the model at the sites of the various obstructions in the river; is that right?

A. Let me review the errors.

Q. No.

A. No; it isn't right, for the simple reason that I have already given you three errors in his adjustment. Let me recite them over again.

Q. Just a moment.

By the COURT. Gentlemene, I think I will have to take charge of proceedings.

By the COURT:

Q. Col. Watkins, you answer the questions as they are asked you. You have got a right to explain your answer to a reasonable extent, but I am somewhat in the same position as Mr.
2867 Jackson. You keep referring to three errors, and I can't remember where you have pointed out any except two, one relating to the volume of the water and the one to what you say is a mislocation of the baffles on the model. Let us expedite this thing by a little order.

By Mr. JACKSON. All I want him to do is list them and I got two, as I understand it. Now I want to find out is there another one.

A. May I repeat what I have already said as to the errors?

By Mr. JACKSON:

Q. Please don't.

By the COURT. Let him answer it in his own way.

By Mr. JACKSON. The trouble is I will be no further ahead when he gets through and will have to start over again.

A. The first error is the fact that he adjusted his model to conform to the waves of the 1930 tests. That is error No. 1.

By Mr. JACKSON:

Q. Just a moment.

By Mr. THOMPSON. Let him finish.

By the COURT. Go ahead, Mr. Jackson.

By Mr. JACKSON:

Q. Is it your contention that the integrating model ought not to have been adjusted to conform to the results of the 1930 wave tests?

A. You can utilize them for adjusting them to the 1930 wave tests but you can't just go and pick out any wave you like as apparently the witness did, from the results he obtained.

Now, may I answer and show you just why you can't follow those unless you are careful about just what you get from those tests?

By Mr. JACKSON. If Your Honor please, all I want to do is to get a list of the alleged errors.

By the COURT. Yes, that is all I want and if this witness will start the statements over——

A. I will be glad to give each one without an interrup-
2868 tion, if I may.

By the COURT. The trouble is, Col. Watkins, that after you have given each one you want to enter into a long explanation of it which is not being asked for. Now, enumerate the errors, as briefly as possible.

A. Error No. 1: The model was adjusted to conform to the 1930 wave test, which, on account of the way the test was made, had great reduction in amplitude and reduction in volume in the admitted Saturday and Sunday trough. That is error No. 1.

Error Number 2: The witness states that he did not consider volume in adjusting his model. That is error Number 2.

The third, as I stated, he did not locate his baffles to conform to the location of the various obstructions of stream flow. Those are the three errors I have listed.

Q. Are there any others in the adjustment of the model?

A. He did not go into detail about flood storage or channel storage. That is an important factor in this problem.

Q. Do you claim any other errors in the adjustment of this model?

A. No, sir; but he did not give details on those things which are important factors.

Q. Do you contend that, with a properly constructed integrating model, Professor Thomas should not have been able to reproduce the essential results of the 1930 wave tests?

A. No; I don't claim he could not. He no doubt could.

Q. Don't you think that a properly constructed integrating model should be able to reproduce them?

A. He probably did reproduce them very accurately apparently—the 1930 wave test—it probably is.

Q. Aren't you sufficiently familiar——

A. (Interrupting.) The trouble was, the results that he claimed indicate to me very conclusively that he adopted in the 1930 wave

tests, waves that had too small a persistency, and that is the fact in the case.

Q. In other words, the results do not accord with your opinion and you think they are wrong?

A. They do not conform with what I know would be about right.

Q. Don't you know enough about an integrating model to
2869 know that the volume is automatically reflected in the operation of the model?

A. We are talking about waves going down stream in forms and shapes.

Q. Will you answer my question?

A. I will say, if he did not consider volume in adjusting the integrating model—I don't care what his formula was, you will not get correct results.

Q. I am asking you if you know enough about an integrating model to know that it automatically reflects the volume?

A. Sure; maybe in stream flow and that kind of thing.

Q. Don't you know enough about integrating models to know that baffles are never located in the models to correspond with the location of the obstructions of nature, but merely to reproduce the conditions of stream flow to correspond with the hydraulic lines that control at the control points?

A. I know that is fine for determining currents and those things, but I know that the factors controlling the waves are so complex that you will not get good results if you group them together in one place or another and don't distribute them in the stream. I know that. I know that.

Q. You know the results of an integrating model, although you never constructed one?

A. Yes, sir.

Q. Do they test the same as a scale model?

A. Yes, sir. I can say they could, because I have had so much experience following waves down stream, and I know what will happen to a wave all the way down and how it will behave. I have traced them so many thousand miles downstream, I know the factors involved.

Q. Colonel Watkins, what is the natural period of oscillation in pool No. 6, on Kanawha River?

A. I don't know. I think I saw some peaks in the curves
2870 of Mr. Thomas' testimony that indicated about two hours, and I think that is correct.

Q. Do you think 2.4 might be correct?

A. That is about right, I guess.

Q. Yesterday, you testified about some tests made by Professor Thomas at Marmet pool?

A. Yes, sir.

Q. And you referred to a flow of 3,200 cubic feet per second. What did that flow represent?

A. I took that from the average height of the gage at Kanawha Falls, indicated on the chart [witness indicates paper in his hand].

Q. Did you intend that flow to represent the base flow that existed at the time of the tests?

A. That is what I understood it was.

Q. And you got that, you say, from the Kanawha Falls gage?

A. Here it is shown on your chart; yes, sir [indicating].

Q. Can you answer the question?

A. Yes, sir. This one on the chart.

Q. I will ask that the question be read. (The question is read). That is, your 3,200 second-feet figures was based on that?

A. Yes, sir; as shown as on this chart [indicating].

Q. Did that represent the flow out of the power station at Marmet prior to the tests?

A. It represented the flow at Kanawha Falls. It was approximately the same so far as the factors in this problem are concerned, for measuring the stages in the gage heights which would occur.

Q. That would depend on whether or not the flow through the power station was any different at London and Marmet, wouldn't it?

A. No, sir; for the reason that all the discharges is to give you just the approximate place on this rating curve in the stream so that you may measure the changes that took place with a discharge of so much, and if you make an error of ten per-
2871 cent in it, it will not materially change the results, so that any error I made in assuming 3,200 cubic feet per second was not the base flow of the stream, will not greatly affect the results.

Q. Regardless of your feeling about that, the fact is that the flow down in the Marmet pool, any flow, and the Number 6 pool, whatever it is, depends on the amount of flow through the power station and not on the flow at Kanawha Falls?

A. The wave tests——

Q. (Interrupting.) The tests were taken when?

A. The 14th and 15th.

By Mr. JACKSON:

Q. Is that right?

A. Oh, yes.

Q. What time was the test wave taken at Marmet Power station?

A. According to the chart, it was started—your load at two P. M., on the 14th.

Q. What was the power out of Marmet power station just before the wave commenced at that time, two o'clock on August 14th?

A. I don't know exactly what it was, but I assume, for the purpose of this problem, that the flow, 3,200 C. F. S., as indicated by the Kanawha Falls gage, was base flow. Any error that I made would not materially affect the problem.

Q. You undertook to criticize these results yesterday on the assumption that the base flow was that shown by the Kanawha Falls gage?

A. Yes, sir.

Q. And you took that to be 3,200 second-feet?

A. Yes, sir.

Q. If that base flow at Marmet power station at the time of the wave was 1,800 second-feet, that would be a great deal more than ten percent error in the assumption, wouldn't it?

A. If it were 1,800 second-feet.

Q. It would be a forty-five percent error, wouldn't it?

A. It would be about that, but may I state that it would
2872 not materially affect the results, except it would make the wave go down much lower below the horizontal.

Q. Now, what was the power output at Marmet just before the wave was initiated?

A. At Marmet?

Q. Yes.

A. The London power house.

Q. Marmet?

A. It is on your chart here [indicating].

Q. You said London? I just wanted to correct you.

A. It is on the chart here [indicating]; you show it to be one o'clock it is 3,000 k.w.

Q. What was the flow corresponding to that 3,000 k.w. out of Marmet power station?

A. I don't know exactly what it was at that time. I took your figure of a change in flow of 4,100 cubic feet per second, which Mr. Thomas said he used.

Q. You are talking about the increase. I am talking about the base flow. Don't you know the 3,000 k.w. at Marmet would correspond to a flow of about 1,800 second feet?

A. No; I did not go into the details of checking exactly the flows here. What I was interested in was the change. It is the change that matters. As I said, you would not greatly change results. The results that you get, if the flow happened to be 1,800 feet per second and not 3,200; it would not greatly affect

the results, except, as I said, it would go lower—the lower part of the wave would go down below horizontal further.

Q. Laying that to one side, you undertook to criticize Professor Thomas' results without even attempting to determine what was the actual base flow out of the Marmet power station
2873 before the wave was initiated?

A. I had no intention of criticizing the results. All I did was analyze them.

Q. You undertook to——

A. (Interrupting.) I undertook to analyze, not criticize the results, and I did take into consideration those factors necessary for a correct analysis of the problem.

Q. According to your idea, the correct analysis of the problem did not require a determination of that—what was the wave at the Marmet power station?

A. It requires you to determine what portion of the rating curve to use in determining the change. If that were only 1,800 second feet, it would make a slight difference only, but not enough to materially affect the situation.

Q. Let me know if 1,800 second feet is not right, later on in the day.

A. I will state that 1,800 is correct, if you say so. I will accept that, if it is correct, because it will not materially affect the results. It will make them smaller, but not materially affect it, because you have written the curve right where it was at the beginning and you have it where it was at the end. I measured that rating curve change and I know it gave approximately the right results. If I took 1,800 instead of 3,200, it will not greatly change it. You can take it and look at it.

Q. You mean it will not change your opinion?

A. It will not change the results. It is known. That is, it is so. It is measured here in black and white—written.

Q. What was the gage reading at Marmet lower gate power station during the base flow discharge immediately preceding the formation of the wave?

A. The Marmet lower gage?

Q. Yes, sir.

2874 A. It was at 564 and about .2.

Q. Is .17 about right—564.17?

A. According to this curve, it is nearer 18.

Q. In your testimony yesterday, you referred to Government's Exhibit 117-b. Will you please refer to that Exhibit now and give the appropriate back water curve on the Exhibit and state what it shows as to the flow corresponding to elevation 564.2?

A. (Witness refers to papers.) You will have to express the flow, 564.2, in discharge per cubic feet per second to get the elevation on this curve. I used 3,200 cubic feet.

Q. What does your chart show to be the discharge at elevation 564.2, on your Exhibit 117–b?

A. Oh, yes, I see—564.2—[witness examines papers] it shows a discharge of 4,200 I believe.

Q. 4,200 second-feet?

A. I believe that is it.

Q. What is the matter with your back water curve?

A. What is that?

Q. What is the matter with your back water curve?

A. Nothing, so far as natural slope is concerned. Maybe it is not high enough or low enough in particular places.

Q. You have agreed that the discharge at that time was 1,800 second-feet, and would you think the back water curve, which gives you 4,200 second-feet, when the actual discharge was 1,800 second-feet, was in error or not?

A. We will look at this; an answer to your question requires consideration of questions that have gone before and must have an explanation. That is all there is to it, and that explanation is that, when you look on the days, you see that on the immediately preceding days, there was a very sharp power wave, which unquestionably did affect the gage height, and it would measure the discharges at this particular time. That is the answer there.

By Mr. JACKSON. I will ask that the question be read. [The question is read.]

2875 A. I think my answer is excellent to that, because I explained the factors which were existing at the very time the measurements were made, which I said did affect the gage height, therefore that would affect the gage reading.

Q. Will you say whether or not you think that result would indicate the back water curve to be in error or not?

A. No, sir, it does not, because you take those factors and it will not be due to the gage height.

Q. I just want your views.

A. I used the average flow to go on.

Q. Did you take the flow at Kanawha Falls?

A. I took the actual flows existing at the time the tests were made.

Q. And the 1,800 was actually existing at the time of the test?

A. Yes, sir, but was it the average daily flow. The Kanawha Falls gage indicated it was 3,100. I don't give a dern what it was when the test was taken, but I am talking about the average daily flow. That is the one to use. That is correct, you betcha.

Q. Starting, Colonel Watkins, with the known flow and a known gage height at the foot of Marmet Dam and power sta-

tion, will an increase of discharge from the power station cause a change in the water level?

A. You mean of the crest of the dam?

Q. I mean tail water increase.

A. The crest of the dam.

Q. No, the tail water?

A. Will an increase in flow cause that? You would expect it to unless some other factors entered.

Q. For an increase of 4,100 second-feet flow through Marmet Station being the amount which you say Professor Thomas gradually increased the flow during the afternoon——

A. [Interrupting.] He said that.

2876 Q. Do you challenge it?

A. No, sir.

Q. (Continuing.) What increase in water level would that produce below Marmet Dam?

A. I believe I measured it yesterday and it was about——

Q. (Interrupting.) Look at Exhibit 117-b and tell me the results.

A. (Witness examines papers.) With an average daily flow of 3,200——

Q. (Interrupting.) I didn't ask you that.

A. That is what I have to look at to get the correct measurement for this problem. You want me to measure it and I will measure it. I have to do that to get the correct measurement.

Q. Give me your answer.

A. Well, let me give you my answer. It is a change in discharge of approximately 1.2 feet.

Q. What elevation would that result in?

A. A final elevation of approximately 564, or approximately 565.

Q. Wouldn't it be better than that?

A. Just a slight shade above it.

Q. You start with 564.2 and add 1.2 to that, according to your estimate; is that right?

A. No, sir, I would look at the curve because of the other factors. You have a little sharp wave just above it—before it, and it is bound to have an effect on what the gage height is at the time this was taken. Measure it from where it was shown on the curve.

Q. Tell me what elevation Marmet gage actually attained after the flow had been increased 4,100 second-feet.

A. According to the chart, it rose to 565.35.

Q. That would be very close to the sum of the first elevation, 564.2, that you gave me, plus 1.2 rise you found for the

2877 increased flow of 4,100 second feet; that is, the total would be 565.4?

A. It is approximately that, a little bit less.

Q. Tell me what was the minimum power load at Marmet power station at the end of the test period.

A. At Marmet power station?

Q. Yes.

A. Your curve indicates that it actually fell to about 2,000 k.w., but all the way down, you are putting your load in and out and popping it up and down and immediately after that you are popping it back to three and then you pop it back to two again.

Q. It shows two k.w.'s as a minimum?

A. Yes, sir.

Q. Is that that load less by 1,000 k.w. than the load corresponding to that base flow at noon, August 14th.

A. Yes, sir.

By Mr. JACKSON:

Q. And what do you find to be the discharge from the Marmet power station corresponding to the load of 2,000 k.w.?

A. Measured on what?

Q. In any way that you know, if you know.

A. You have to reduce that to discharge.

Q. Do you know how?

A. Yes, I know how they do it. What do you say it was? I will accept it; it does not enter into this problem exactly.

Q. Do you think 1,200 second feet is about right?

A. You can draw it if you want. It does not affect it materially.

Q. Are you willing to accept 1,200 second-feet as about right?

A. Something like that.

Q. According to your Exhibit 117–B, what pool elevation in No. 6, at No. 6 dam, would you expect for a discharge

2878 of 1,200 second-feet?

A. No. 6 pool, at No. 6 dam?

Q. Yes.

A. What elevation would I expect there?

Q. Yes; look at your exhibit 117–B.

A. Yes; I see, but, before I could measure this Exhibit 117–B right, I have to know what factors are affecting the heights at that particular time. You popped a little load up just before, and I can't accurately measure on here unless I put in an analytical study of it like I have on this; but, if it were actually that, and no other factor, if you take 1,800 feet——

Q. (Interposing.) 1,200 feet?

A. It would be at an elevation of about 563.2, or something like that.

A. I would like to have defendant's counsel correct his statement that these are not justified by facts. Furthermore, I did not make a lot of general categorical statements. I simply read what was written on the curve.

By Mr. JACKSON:

Q. Now, taking into consideration the base flow of 1,800 and the increase of 4,100, the maximum discharge at Marmet was 5,900 second-feet; what was the flow at the peak of the wave—5,900 under those conditions?

A. I would like to repeat, the Kanawha Falls gage indicates 3,200 second-feet per day; that should be taken at a base flow for the problem instead of what otherwise happened to be measured at that time, and then add 4,100 cubic feet per second and you have 7,300 cubic feet per second.

Q. All right; I take the 7,300 second-feet: Now, cutting down the 1,200 second-feet, which we agreed was the discharge corresponding to the power production at the end of the tests; what elevation would you have at the same gage?

A. Where am I going to measure it from?

2879 Q. At the same gage?

A. You can't use the rating curve for measuring the height you are going to have for a certain discharge at the end of the measurement. This thing very clearly shows that you had the force of gravity and the force of momentum or volume forcing it down for 20 hours, and it actually dropped below in the average during the falling stage 1.1 below the point of rest, and, of course, you can't measure the discharge at that particular time; but, if you will look on the hydrograph, you will see what it is.

Q. All right. Is there any time at the end of the test when you found the upper end of pool No. 6 lower than the lower end of that pool?

A. No; according to the data from the Engineers Office and that the lock-master has given to me, it was about 17 hundredths of a foot above the water at the crest of No. 6 dam.

Q. Well, it is obvious, isn't it, Col. Watkins, that if at a given time you had a flow at a given point, for instance below the Marmet power station, of 5,000 second-feet, and at a later time you had a flow of 3,000 second-feet, you would expect a lower water elevation with the lower flow, wouldn't you, at the same point?

A. You would expect a low elevation for the same flow if there were not other factors which came in and kept it from being that.

Q. In general, a reduction of flow at a given point will mean a reduction in elevation?

A. It reduces the expected point of rest.

Q. A reduction in flow at a given point will mean a reduced elevation of water at that point, will it not?

A. It means just as I said, the effective point of rest will be——

Q. (Interposing.) I am not asking about a point of
2880 rest, but I asked you whether or not, if you reduced the flow at a given point, if you do not expect the elevation of water will be reduced?

A. Yes.

Q. And if you increase the flow at a given point, you will expect the elevation to rise, will you not?

A. Yes.

Q. That is all.

A. May I add that before you can actually determine where it will be, you have got to look at the other factors, because this problem shows it just as clearly as night from day.

2881 H. G. GERDES, recalled, testified in rebuttal as follows:

By Mr. GATCHELL:

Q. Mr. Gerdes, Mr. Yarbro testified that each one of the pictures in Exhibit 592 fairly and accurately portrayed the situation described in the legend at the bottom of the picture; will you briefly tell the Court if that statement is correct?

A. That statement is not correct.

Q. Will you please explain very briefly what you mean by that?

Mr. JACKSON. I move to strike out the first general statement.

The COURT. I will let it stay in.

Mr. JACKSON. Exception.

Q. Will you examine the photographs at Wylie's Falls?

A. I have examined those.

Q. Will you tell the Court if those pictures, or first, how many pictures show Wylie's Falls?

A. Three.

Q. What are the numbers?

A. Nos. 106, 107 and 108.

Q. Do those three pictures fairly portray the shoals at Wylie's Falls?

By Mr. JACKSON: I object to that. The pictures show, #106 "View of Wylie's Falls from left bank, June 1, 1936"; #107 "View of Wylie's Falls from right bank, June 29, 1936"; #108 "View of Wylie's Falls from right bank, June 29, 1936," overlaps Picture #107. I think all the witness may be asked is whether or not he is prepared to testify those pictures do not accurately represent the scene that met the eye at the place indicated in the photographs on the dates indicated.

By the COURT. He may answer.

By Mr. JACKSON. Exception.

A. These three pictures while taken from both banks, looking at Wylie's Falls, are nevertheless so taken that a significant part of Wylie's Falls is omitted from all three views. It should be possible, in my opinion, in three pictures to cover the Falls and show all of them. The navigation channel dug by the U. S. Engineers is not shown in any of the three pictures, although it is situated at the Falls, at the right bank of the river.

Q. Is it discernible from the place at which these pictures were taken?

A. To one who has been at Wylie's Falls and knows where the navigation channel is it may be identified on photograph #106 and #108, although to one who has not spent sometime on the ground at Wylie's Falls it would certainly be impossible to recognize it.

By Mr. JACKSON. I move to strike out all the witness' testimony. He first testified it doesn't represent the scene to show the channel, and now he undertakes to point out the navigation chute is shown by two other pictures.

By the COURT. The answer may stand.

By Mr. JACKSON. Exception.

By Mr. GATCHELL:

2882 Q. I show you Defendant's Exhibit #555, photographs taken by T. A. Patton. Mr. Patton testified that these photographs fairly portray the situation at the time and place mentioned, at the bottom of each picture. Have you examined those?

A. I have.

Q. Are his statements correct?

By Mr. JACKSON. I would like to ask a qualifying question. Mr. Gerdes, were you present at the time and place indicated by these photographs, when the photographs were taken?

A. I have been present at the places but not at the times mentioned.

By Mr. JACKSON. I object to the question. Obviously he doesn't know anything about the scene that met the eye when the pictures were taken.

A. That is not correct.

Q. Will you explain to the Court what you mean?

A. Referring to photographs 114 and 115, which are again two view of Wylie's Falls, neither photograph shows the navigation channel at the right bank at the end of the Falls in such a way that it can be recognized or identified by one not otherwise familiar with the site. The remainder of the photographs, some of them [interrupted]. Some of them fairly represent the river——

By Mr. JACKSON. What is the question pending, may I ask?

By Mr. GATCHELL. Whether Mr. Patton's statement these photographs fairly portray the situation is correct.

By Mr. JACKSON. His testimony is this, that these photographs fairly show the scene that met the eye when the photographs were taken. If this witness is prepared to rebut that, all right.

A. Some of the photographs represent fairly the scene which they purport to show.

By Mr. GATCHELL:

Q. On page 5182 of the record, the witness Patton testified that these photographs contained in Exhibit 555 which I have
2883 handed you were taken on September 29, 1930, and can you inform the Court as to the condition of the river, the discharge in the river at that time?

By Mr. JACKSON. I object to that as not in rebuttal of anything.

By the COURT. I think he may answer that.

By Mr. GATCHELL:

Q. Will you give us the stream flow?

A. The river flow at the time these photographs were taken was extremely low, the discharge being somewhere between one-half and two-thirds of ordinary low water. At Wylie's Falls the interpolated discharge was 1,200 cubic feet per second and at Bull Falls 1,260 cubic feet per second and at the location of Photograph No. 126, which is the lowermost one of the group, one thousand three hundred cubic feet per second.

Q. I show you defendant's exhibit 554. Have you examined those pictures?

A. I have.

Q. The witness Slocum, who introduced these pictures testified that they were taken in November 1931. Can you give the stream flow at the time those pictures were taken?

A. I can.

Q. Will you give it, please?

A. The stream flow during the time these photographs were taken was also very low, being between a half and two-thirds of low water.

By Mr. JACKSON. I object to the characterization. He is asked to give what it was, and I think that is what he should do.

A. The interpolated discharge at Foster Falls, that is, interpolated between the U. S. G. S. Gaging points along the river—the interpolated discharge at Foster Falls was either 700 or 760 cubic feet per second, depending upon whether the date was the 4th or the 26th, it not being stated by Mr. Slocum on which of the two dates the individual photographs were taken. At Alhonia, at

Photograph No. 18, the discharge as interpolated would be 1,080 second feet, that being for the date of the fifth of November, and at Photograph No. 46, at Radford, 920 second feet if taken on the 6th or 1,050 if taken on the 24th, these being very close together, and at the last photograph of the group, one mile above Eggleston, 1,140 cubic feet per second.

By Mr. JACKSON:

Q. What date was that?

2884 A. November 6th.

By Mr. GATCHELL:

Q. Is that the normal flow of New River at that time?

By Mr. JACKSON. I object to that as not proper rebuttal, going into the question of the normal flow.

By the COURT. He can answer it.

A. No, that is a little more than half of the ordinary summer low water at New River.

2885 H. G. GERDES

Rebuttal—Direct examination by Mr. GATCHELL:

Q. Prof. Thomas testified that the pool fluctuations shown on Government Exhibit 229 were caused by variations of the load at Marmet and other stations. When you introduced the exhibit, did you testify as to the causes of these oscillations shown on Government Exhibit 229?

A. I did not.

Q. I show you Government Exhibit 229 and ask you what that shows as to the causes of the fluctuations regarding which you did testify?

By Mr. JACKSON. I object to that. He is asking him now to repeat his testimony.

By the COURT. He may answer.

A. I have reference particularly to the oscillations in the Marmet pool following the reduction in load on the London Power Plant, which started at about 4 p. m. on June 16, 1936, and continued through five successive alternate risings and fallings of the water at the two ends of the Marmet pool with a gradually dimishing amplitude, the pool finally coming to a steady state at about 8 p. m. on that evening. The power plant records showed that at that time both London and Marmet plants were operating with relatively little fluctuation in load, which, together with the observed facts of these rhythmic and opposite fluctuations at the two ends of the Marmet pool, make the fact that it must have been caused by the oscillation of the pool as it settled down to a steady

state after having taken a part of the load off of the power plant; that is, the water surface, on a slope oscillated back and forth five times, before it finally settled down to a new smaller slope.

By Mr. GATCHELL:

Q. Prof. Thomas compared the hydrograph of the 1930 wave tests in exhibit 141 to show that the typical wave illustrated on his Exhibit No. 594 would be reduced in amplitude from 9,000 c. f. s. to 3,500 c. f. s. between Radford and Kanawha Falls. Have you studied the comparison which he made in this connection and found any errors in it?

2886 A. I have studied it and I have found that it is incorrect.

Q. Will you explain that statement?

A. I studied the comparison made by Prof. Thomas which rested upon the 1930 wave tests, as shown on Exhibit 141, and the other hydrographs of that test, and came to the conclusion that his interpretation or his findings were in error and I have embodied my study in a diagram on which I have platted the persistence in amplitude from Radford to Lock #2 of all of the 1930 wave tests against the amplitude of those waves at Radford.

By Mr. JACKSON, Has it been offered in evidence yet?

By Mr. GATCHELL. I offer this in evidence, Your Honor.

By Mr. JACKSON. I object, because it appears from a mere inspection that it is nothing more than an attempt to interpret again the 1930 wave tests as to which the Government has gone into exhaustive detail on direct, and it is a mere attempt, in a subterfuge, in rebuttal, to re-state their case. Certainly they have described at great length by Mr. Kramer, Col. Watkins, Mr. McWhorter and Mr. Gerdes, what they thought about these wave tests on their main case and now they want to interpret them again.

By Mr. GATCHELL. Your Honor this is, on its face, simply an analysis of the persistence in amplitude of all waves in the March, 1930 wave tests upon which Prof. Thomas based his comparison as to the persistence in amplitude of his typical wave that he illustrated on his Exhibit 594. Now, all that we are attempting to do is to see if his comparison was based upon a sound premise. If it was, then, of course, his testimony is entitled to some weight. If it was not, then we think we are entitled to show that.

By the COURT. I don't think that is what you are doing. If the witness is able to point out certain conditions or assumptions made by Prof. Thomas, which, in his opinion, were erroneous, he may be permitted to do that. I don't understand that is what you are undertaking to do. So far the witness has contented himself by saying that Prof. Thomas' calculations and conclusions are erroneous and then undertaking by a chart to reiterate testimony that he himself has previously given in chief and other witnesses have given in substance also.

By Mr. JACKSON. An attempt to reinterpret these 1930 wave tests which they have done repeatedly on their direct testimony.

By Mr. GATCHELL. On examination in chief this witness testified regarding two waves, Nos. 4 and 10, and Prof. Thomas said those waves were not typical and he took other waves. We are simply saying instead of having all this discussion as to whether certain waves are typical and other waves are typical, let us examine the whole 1930 wave tests, a test which was carried out under the entire control of the defendant. Their engineer was in charge of it and had control of the whole thing. All that we are saying is that Prof. Thomas based his comparison upon an inaccurate premise.

By the COURT. Ask him what that was. I let Col. Watkins be examined on the same line where he undertook to point out what he said were erroneous premises, on which some other witness based conclusions.

By Mr. JACKSON. May I make this observation: It is a subterfuge to have this witness put in a new interpretation of these 1930 wave tests that they have interpreted three or four times on direct, and if their interpretation is right, and Prof. Thomas' is different, then obviously there is something wrong with his premise, but I don't think that they can come in and go over their testimony again on the 1930 wave tests.

By the COURT. I understand that. If, for instance, we have a conflicting interpretation regarding these wave tests and this witness can say "I will show you why there is a conflict, because the witness Thomas took certain erroneous conclusions or made erroneous assumptions, which I can point out to you to show wherein he was in error." I think that would be proper rebuttal, and that is what I am confining them to.

By Mr. GATCHELL:

Q. Will you tell the Court what this chart represents?

By Mr. JACKSON. I object to that.

A. This chart represents, to the best of my ability, the relation between the 1930 wave tests upon which Prof. Thomas based his estimates, and the estimates of Prof. Thomas which he said are based upon those tests. There is shown here, platted on the height scale the persistence in amplitude from Radford to Lock #2 of each wave of the 1930 tests, that is, the ratio of how high the wave was at the end of the run as a percentage of its height at the beginning. On the horizontal scale there is shown the amplitude at Radford, that is, the height of each wave at the beginning, and each point thus represents the relative strength of the wave at the end of the run at Lock #2, platted against its height at the

beginning. I have taken it to be a common sense proposition that the bigger a wave is—that in any given channel, the bigger a wave is at the start, the bigger it will be at some given distance down that channel, and I have sought in this diagram to show how the waves of the 1930 tests conform to that common sense, simple idea, and, in so doing, point out that the estimates that Prof. Thomas has made, based upon the same data and arrived at by more complicated means, appear to me to be in error.

By the COURT:

Q. Mr. Gerdes, isn't all of this computation about the
2887 results of these wave tests exactly what the Government introduced at great length in chief, or they had abundant opportunity to introduce?

A. No, sir; I do not believe that it is.

By the COURT. I have said two or three times if he can pick out premises or conditions which the other witness used in this calculation and point out where they are erroneous, he may do so, but that isn't what you are trying to do. You are trying to utilize that to open up this whole subject of wave tests and evidence that would reiterate what he has previously testified to, and any number of other witnesses have testified to in chief, or which they have certainly had an abundant opportunity to testify to.

By Mr. GATCHELL. Your Honor, we certainly don't want to open up the 1930 wave tests again, and at the time Prof. Thomas was on, he discussed two or three of these waves. Obviously, Your Honor, the entire series of tests should be a more accurate representation than a few waves picked out at random. All that we are asking this witness is if he can show us wherein the premise of Prof. Thomas was erroneous.

By the COURT. All right, wherein was the premise of Prof. Thomas erroneous?

My Mr. GATCHELL:

Q. Can you answer that question?

A. I can. Prof. Thomas used the 1930 wave tests to build and calibrate his model, from which he drew his conclusions, that is, the waves t emselves, and, among other things, principally their amplitude, were the premise. I have here platted——

By the COURT:

Q. Where was he wrong in doing that? What was erroneous in using the 1930 wave tests as a basis for his calculations?

A. There was nothing wrong in that.

Q. Where else did he err?

A. The error came in in the way in which he used them.

Q. How did he err in the way in which he used them?

A. By using them in a model which gave erroneous results, which error I have here demonstrated. There are a number of possible deficiencies in the model which might have led to this erroneous result. I did not think it proper to endeavor to follow Prof. Thomas through all of the operations of his model.

By Mr. JACKSON. I move to strike out the testimony so far. It is obviously nothing more than an attempt to reiterate what was covered before.

By the COURT. It looks like it to me.

A. The point of the diagram is——

By Mr. JACKSON. One moment.

By the COURT. Go ahead.

A. The whole point of this diagram is that these waves indicate a general trend, that is, they follow in general—although there are many minor complications which have been brought up—a simple rule. That rule points to a definite amplitude for the wave of the size which will be emitted by the Radford power plant.

By the COURT. I think you have gone far enough.

No, gentlemen, I can't admit that.

By Mr. GATCHELL. Your Honor, may we have an exception to your exclusion of this testimony and say, were this witness permitted to testify, he would show that from the 1930 wave tests used by Prof. Thomas as the basis upon which he compared the persistence in amplitude of his typical wave shown in Defendant's Exhibit 594, that this witness would say that the 1930 waves show that the larger the wave passing Radford, the greater is the percentage of persistence of the amplitude of that wave at the time it reaches Kanawha Falls.

By the COURT. Mr. Gatchell, in your avowal, and in some of your questions, you injected something about the tests made by Mr. Thomas, carrying the implication that you were in position to point out where his tests were erroneous. This very avowal would carry that implication because you make some reference to Prof. Thomas' results obtained and that carries the implication that you can point out some erroneous basis for his conclusion. I have invited you a half dozen times and asked the witness to point out anything of that sort, if he can, and the witness hasn't done that and wishes to go off into a general discussion of the wave tests, giving his conclusions about it, pointing out no error in Prof. Thomas' method of computation except to say that he has another method by which he reached a different conclusion. Any time you can point out, as I allowed Col. Watkins to point out, any supposed errors, fallacious conditions, upon which conclusions were reached by defendant's witnesses, you may do so, but I will not let this witness say that witness Thomas expressed certain

views and reached certain conclusions and we now want to point out those as being erroneous by showing we reached a different conclusion in a different way. That was something you undertook to do in chief and certainly had abundant opportunity to do.

A. I believe the error in Prof. Thomas' methods and apparatus to be the way in which he calibrated his so-called integrating model, which is another way of saying approximating
2888 model. He calibrated that from the 1930 wave tests in such a manner that if it were calibrated in a certain manner on this distorted scale it would give distorted results. I believe that would be one factor. Another one, I believe to be the microscopic scale of his model which renders it highly unlikely that accurate results could be obtained.

By Mr. GATCHELL:

Q. Can you tell the Court then the distortion in the integrating model?

By Mr. JACKSON. Are you going to offer evidence now that the scale of the integrating model was different than Prof. Thomas gave?

By Mr. GATCHELL. To simply show the distortion in Prof. Thomas' integrating model.

By Mr. JACKSON. Prof. Thomas gave the scale of his model and exactly what it is in every way and unless this witness is prepared now to say that he knows that is false or untrue——

By the COURT. But if the witness can point out where a model, made to the scale described, would produce certain inaccurate results, I think he is entitled to do that.

A. Well, this integrating model is an approximate device which consists of a condensed representation of a short piece of river which is set up and adjusted repeatedly so as to give at the four or five places for which there are data which are selected so that when a wave, possessing the characteristics of one which it is desired to repeat, say one of the 1930 waves, is passed through the model and makes the right shape at the first station on the model, then the succeeding stations on the model are adjusted so that it gives an answer at those stations corresponding to the shape of the 1930 wave. That is a matter of successive adjustment and balance and the chances for error in the model due to the non-representation of the river between these stations and the small scale of the model, are such as to render it unlikely that when a wave, possessing some different characteristics and being considerably larger than the waves which were used to calibrate the model, is run through it, an accurate result would be obtained, and as I have tried to show by this diagram here, apparently an accurate result has not been obtained.

By Mr. GATCHELL:

Q. Do these 1930 wave tests show that the small waves have as high a percentage of persistence as the larger waves passing Radford?

A. They do not.

By Mr. JACKSON. I move to strike out the answer and I object because that is clearly going into their case in chief again.

By Mr. GATCHELL:

Q. Professor Thomas testified that his typical Radford wave, shown on Exhibit 594, would decrease in amplitude from
2889 9,000 second feet at Radford, to 3500 second feet at Kanawha Falls. Have you found any errors in the premises upon which this conclusion is based?

A. Professor Thomas said that in the determination of the persistency of the waves from Radford to Kanawha Falls, he used an integrating model and that he checked the accuracy of the results obtained from the model by his study of the 1930 waves. In making a check of the 1930 waves, to determine if the premises of Professor Thomas was sound, I found that the facts as to the 1930 waves did not support his conclusion, and these facts are:

That the 1930 wave tests show that the larger the wave passed Radford, the greater the persistence in amplitude at Lock 2.

By Mr. JACKSON. That is simply a method by counsel to circumvent the ruling of the Court this morning. He is undertaking to testify that the waves show certain results as to amplitude. What the decrease was was given by Mr. McWhorter and Mr. Watkins and another witness, and I think by this witness also, but I am not certain whether or not this witness did, but certainly they had an opportunity to testify as to what happened to every wave, and now he is seeking to restate it.

By the COURT:

Q. What are the erroneous premises he adopted?

A. The erroneous premises that he adopted with the 1930 wave tests, was that larger waves have smaller percentage of persistencies.

By Mr. JACKSON. Will you point to the transcript of the evidence here where that testimony occurs, Mr. Gatchell.

By Mr. GATCHELL. On page 5732, Your Honor, Professor Thomas was asked [reading.]

"Q. Professor Thomas, in your opinion, what would be the amplitude of a power tide emitted from the Radford station in the form and volume shown on Exhibit 594, when it reached Kanawha Falls?"

By Mr. GATCHELL. And his answer was as follows: [Reading.]

"A. In my opinion, the amplitude of such a tide would be approximately 3,500 second-feet."

By Mr. GATCHELL (continuing). You will have to go through the whole testimony of Professor Thomas to get the other facts upon which he based this conclusion and the premises he used.

By the COURT. The objection will be SUSTAINED.

By Mr. GATCHELL. Will your Honor grant us an exception to the ruling of the Court on that?

By the COURT. Yes, sir.

By Mr. GATCHELL:

Q. Mr. Gerdes, Professor Thomas said that the power waves would be observed by routine variation in pool levels on the Kanawha River. Is this opinion borne out by the evidence—I mean by the facts?

A. No, it is not.

By Mr. JACKSON. We object to the form of the question—"is this opinion borne out by the facts". That is a conclusion that the Court will draw.

By the COURT. Let it stand.

By Mr. GATCHELL:

Q. What are the facts?

A. The observed fact on the Kanawha River is that the power wave shown on Government Exhibit No. 229, created at the London power plant June 16th, 1936, traveled down the Kanawha River practically undiminished over five dams to the Ohio River.

By the COURT. What wave is it?

By Mr. GATCHELL. Any waves. I beg your pardon. I asked if the conclusion was borne out by the facts, and here is actual evidence that the power wave moved from the London tail race through Lock 11."

By the COURT. Mr. Thomas spoke of waves originating at Radford, and expressed the opinion that they would be ironed out going through the various pools. If you had some man to come in and testify that he is a lock-master near the mouth of the Kanawha River, and that these waves originated up the river and were apparently perceptible there, I might let him testify to that. You are trying to re-open the whole question of the waves by going out and getting some records from some lock masters. If we re-opened this, we would not have these men here with the data, subject to cross-examination, and could not check the accuracy of the data or the conditions of the river at that time. I will not start that at this stage of this case.

By Mr. GATCHELL. Exhibit No. 229 was introduced before and certain errors testified to or were brought out on cross-examina-

tion. Please mark this Government Exhibit No. 229–a. [Indicating.]

The foregoing exhibit was so marked.

By Mr. GATCHELL:

Q. Mr. Gerdes, I show you Government Exhibit No. 229–a, entitled "Automatic gage record, London and Marmet, June 15th to 19th, 1936, and ask you if this is similar to the original Government Exhibit No. 229?

A. Yes, sir.

2890 Q. Does it show corrections made on Government Exhibit No. 229–a?

A. Yes, sir.

Q. What corrections are shown [handing paper to the witness].

A. Following the testimony of Colonel Scheidenholm to the effect that there were errors noted in Government Exhibit No. 229, I rechecked the Exhibit and found it to be correct, with the exception of the lower graph, which is the reading at the upper end of Dam No. 6 pool. On rechecking it, it was found that the lower horizontal lines, forming part of these records, represented a place where the gage had evidently become fastened, and had not recorded the entire fluctuation in the water surface at Marmet on those days—the fluctuation actually being about 3½ feet.

By MR. JACKSON:

Q. What are you doing—correcting it?

A. About 2.6 feet, instead of 1.8 feet, as previously shown. This correct line has been plotted from the lock master's report on the Marmet dam.

By Mr. GATCHELL. We will ask to have this Exhibit marked as Government Exhibit No. 230–a.

I offer this corrected Government Exhibit No. 229–a.

(Said exhibit is marked as indicated.)

By Mr. GATCHELL:

Q. Mr. Gerdes, I show you a paper, marked Exhibit for the Government, No. 230–a, Profile of Water Surface, June 16th, 1936, and ask you if that is similar to the original Government Exhibit No. 230?

A. Yes, sir.

Q. Does it have any differences, and if so, what are they?

A. Following similar testimony regarding this chart—the errors in it—in this graph—it was rechecked and found to be entirely correct, with the exception of five entirely minor and inconsequential errors that I show here corrected to indicate their magnitude.

By Mr. GATCHELL. I offer Government Exhibit No. 230–A, in evidence.

(Said exhibit is filed and marked as indicated.)

By Mr. GATCHELL:

Q. Now, Mr. Gerdes, can you tell us if the Bluestone project is under construction?

A. It is not; I was there last on July 21st, and there was
2891 no construction; no construction work in progress there.

Cross examination by Mr. JACKSON:

Q. In Exhibit 229–A, where you undertook to correct your errors in the original Exhibit 229, did you shift from that gage to any other in the bottom of the graph?

A. The corrected line is shown plotted from the lockmaster's report, which refers to lower gage which is on the other side of the river from the upper gage, a distance of approximately 500 feet.

Q. Did you use a different gage?

A. Yes; but the two are situated at the same point on the river, and should give, within close limits, the same reading.

Q. The old line on Exhibit 229 is still not plotted according to the gage, is it?

A. I believe it is.

Q. Did you change it from the way it was on the other?

A. No.

Q. Will you refer to the gage chart and see if the statement is true?

A. Will it be satisfactory if I refer to copy of the original Exhibit 229?

Q. For the purpose of showing errors.

A. I will refer to the gage chart. I do not fully understand your question.

Q. Mr. Gerdes, you stated that you had found some error in calibrating the integrating model used by Professor Thomas; briefly, what was that error?

A. I stated I found an error in the premises taken by Professor Thomas.

2892 Q. Do you claim to have found any error in calibrating the integrating model by Professor Thomas?

A. I found his results to be inaccurate in his work.

Q. Is that since his results from the integrating model do not agree with the opinion you previously expressed, you concluded that there was an error in calibrating?

A. Since his testimony indicated that his results were partially predicated on the use of the integrating model, I found it did

not lead to the conclusion that might be assumed that it is likely the error might be in the model.

Q. That is all the basis you had for making the positive statement that you discovered an error in calibrating his model?

A. I said the error I found might very likely occur, or would very logically have been in either the calibrating or microscopic scale.

Q. As a matter of fact, you do not know anything about the precise calibration of Professor Thomas' model, do you?

A. Yes; I think I do.

Q. You never saw it?

A. No. I have used similar models, and I am familiar with that sort of work.

Q. It is your testimony that you have made integrating models of the kind that Professor Thomas used?

A. Yes.

Q. Where did you make one?

A. At the University of California.

Q. When.

A. In 1930.

Q. Were you employed there at that time?

A. No; I was employed by the United States Engineering Department.

2893. Q. And you were working there?

A. Yes.

Q. Who was in charge of that?

A. Professor Morrough O'Brien.

Q. That was in 1930?

A. That is right.

Q. Did you say the Bluestone project was under way?

A. I said the Bluestone project was not under construction on July 21, 1936.

2894 . By Mr. THOMPSON. Now I would like to offer in evidence a document submitted to the Circuit Court of Appeals, in the case of the Appalachian Electric Power Company v. George Otis Smith, et al., and also before Mr. Justice Way, when we argued the case before him, which is a photostatic copy of a letter signed by George Otis Smith, addressed to me, and dated April 8, 1932. I would like to read that letter into the record.

By the COURT. What is it about?

By Mr. THOMPSON. That letter has to do with the question of having searched the records of the Federal Power Commission to find out whether there was any authority of the Commission for the signing and sending of the letter by the Secretary of War to the Attorney General. I called your Honor's attention

at the time, when the letter was admitted, to the fact I would bring this letter before your Honor.

By Mr. JACKSON. I object to his as an incompetent method of proof and something gotten up by counsel for the purpose of this litigation.

By Mr. THOMPSON. Not this litigation.

By Mr. JACKSON. And not received in any Court. When counsel says received in Court he means he merely brought it there and it never became a part of any record.

By Mr. THOMPSON. I must contradict everything being said by counsel. [Letter handed to the Court to read.] Your Honor will remember that the minutes of the meeting of the Commission said that twice there was an attempt to have this matter referred to the Attorney General, and the Commission voted it down both times, then the letter was sent by Secretary Hurley, who was Acting Chairman, and this letter shows the searching by George Otis Smith (then the Chairman of the Commission), of the record to find whether there was any authority, and the letter speaks for itself.

By the COURT. In other words, Smith looked through the records to see if he could find any place where the Commission had formally adopted a resolution inviting the opinion of the Attorney General, and didn't find any.

2895 By Mr. THOMPSON. It wasn't in the form of a resolution, but he searched the records to find if any authority by the Commission—resolution is probably the better word.

By Mr. JACKSON. I don't think Mr. Smith if produced as a witness would undertake to say anything like that, but if any proof is to be made, he should be produced.

By the COURT. You may put it in.

By Mr. JACKSON. May our exception be noted, because wholly incompetent and not in rebuttal.

By the COURT. Yes, sir.

By Mr. THOMPSON. This letter then goes in evidence as Government Exhibit #272. (Letter marked and filed Government Exhibit #272.)

Your Honor we want permission to file after the close of the case three licenses. They are recited in the appendix we had in the other case. We sent for them and had certified copies sent down here, but we have lost them, at least I cannot locate them now. They have to do with a license to construct a highway bridge July 28, 1928 at Cotton Hill Station, West Virginia, five miles above the mouth of New River; and another one October 16, 1926, a highway bridge at Stone Cliff, West Virginia, 28 miles above the mouth of New River, and August 29, 1927

a highway toll bridge at Hinton, West Virginia, sixty-six miles above the mouth of New River.

By Mr. JACKSON. We object to them as not in rebuttal of anything.

By Mr. THOMPSON. We asked at the time when we closed our case for permission in the event we could not find some of these exhibits, for permission to put them in and I understood you gave us that permission.

By Mr. JACKSON. We object to them further on the ground they are immaterial and irrelevant.

By the COURT. Objection overruled.

By Mr. JACKSON. Exception.

By Mr. GATCHELL. Your Honor, you will recall that we had an understanding about the aerial photographs which had been taken at the direction of the Federal Power Commission. It seems upon consulting with counsel for defendant there is some misunderstanding with respect to the actual book we desire to introduce as an exhibit, and they have asked us to introduce instead of the actual book we had, a smaller copy.

By Mr. JACKSON. We asked you to introduce the actual book you had, and the actual book you gave to us, instead of a new one we didn't know anything about until last night.

By Mr. GATCHELL. I said there was some misunderstanding as to what was offered.

By Mr. JACKSON. No misunderstanding as to the actual book.

By Mr. GATCHELL. Therefore we ask permission to introduce these aerial photographs with the understanding we will withdraw them to substitute legends more acceptable to counsel for the defendant, and as they seem to think we have improper legends, we will submit the legends to them to see if they agree with what we think is proper, and also some matter appearing in the beginning of the volume which will be omitted, if that is satisfactory.

By Mr. JACKSON. That is agreeable. The one attempted to be offered in the Court of Appeals had a lot of testimony on it and that was to be changed.

(Note.—Book of aerial photographs marked as Government Exhibit No. 273.)

2896 By Mr. AIKEN. For the purpose of clarifying the record in regard to the status of certain Government exhibits, offered in connection with the testimony of Col. Edgerton, I desire to re-offer for all purposes at this time the following Government exhibits. I will make this in the form of a blanket offer in as much as counsel for defendant intimated there was no objection to the re-offering for all purposes of the following Government exhibits:

#88, being the Declaration of Intention.

#89—Assignment of the Declaration of Intention.
#102—The letter transmitting the Assignment of Declaration of Intention.
#90—The application for license.
#90-a—Maps accompanying application for license.
#92—The First Taylor report, dated August 20, 1925.
#93—The underlying reports of the Divison and District Engineers to Exhibit #92.
#96—Letter from General Deakyne dated July 23, 1926.
#98—Report of General Deakyne dated April 12, 1927.

By Mr. JACKSON. We have no objection to the exhibits being received so far as they have been read by Mr. Aiken with this understanding, which I understand to be supported by the record, for instance, I think the report of General Taylor of August 20, 1925, is open to consideration for whatever it might be worth. It is an official report and entitled to be considered for whatever it is worth, but I make that concession upon the understanding the same treatment is accorded to the report of General Taylor of December 25, 1929. I merely want to make that clear, our position being where there is an official report that is germane and made in the regular duties of the officer, it is open to the consideration of the Court for whatever it might be worth, although some parts may not be accepted as evidentiary.

2897 By Mr. AIKEN. I understand that is the status of these various official reports in the record, such as the Taylor report of December 29, 1925, offered by the Defendant.

We desire in addition thereto to reoffer for all purposes Government Exhibit #94, being the report to Col. Edgerton, Chief of Engineers of the Federal Power Commission, by Major Trippe, dated October 14, 1925. I understand that counsel for the defendant objects to this report on the theory or for the reason this report made by Major Trippe to Col. Edgerton is not an official report, in that it did not pass through regular channels into the office of the Chief of Engineers, War Department. Now the record discloses that Col. Edgerton testified that Major Trippe was acting as field representative for the Federal Power Commission and this report was made to him direct upon his request and we feel it should be received as your Honor has received various exhibits on the part of the defendant, these various reports, made by subordinates. For instance the report of Col. Spaulding. We feel in view of the testimony of Col. Edgerton that this report was by Major Trippe directly to him as the field representative of the Federal Power Commission, and has as much dignity as if it had gone through the office of the Division Engineer and into the office of the Chief of Engineers and thence to the Federal Power Commission.

By Mr. JACKSON. The report was simply a letter written by Major Trippe to Col. Edgerton saying he was down there and didn't have time to talk with him, and for him to write him. It was purely an informal matter. I think governmental matters were not handled in that way.

By the COURT. For what purpose is it in?

By Mr. JACKSON. For showing what was before the Federal Power Commission.

By Mr. AIKEN. I do not know whether your Honor recalls
2898 just what the import of this report was. It was a report as to the effect, or what the anticipated effect of the Radford project on navigation on the Kanawha River would be, and expressed the opinion of Major Trippe it would adversely affect navigation.

By the COURT. Was Major Trippe here?

By Mr. AIKEN. Yes, sir.

By the COURT. I will exclude that except for the purpose for which it has already been admitted.

By Mr. AIKEN. Exception.

There are four additional Government exhibits I wish to reoffer for all purposes which fall in the same category, and for that reason I shall offer them all at once.

Exhibit #95, being report of Mr. Kramer on his studies of waves on the Pit River.

#103, 104 and 105, which are similar reports of wave studies on the Pit and Klamath river. Your Honor excluded evidence of the same nature when Mr. Kramer was on the stand, on the ground that he would not be permitted to testify about any conditions on rivers other than New River. We felt at the time Mr. Kramer's comparison of the two rivers and his knowledge of the Pit and Klamath was such as to permit this evidence to be received, and we now desire to make this offer.

By Mr. JACKSON. We renew our objection. They are only in to show what was before the Commission.

By the COURT. I will confine them to the purpose for which they are in.

By Mr. AIKEN. Exception.

By Mr. JONES. (Counsel for Plaintiff.) I desire to have the record incorporate three acts of the State of Virginia.

By the COURT. Make a reference in the record to them.

2899 By Mr. JONES. An Act approved May 6, 1887, (this will be Exhibit No. 274) incorporating the New River Steamboat Company and authorizing them to operate a steamboat on New River.

The next is an Act of February 3, 1888, of the General Assembly of Virginia, to authorize the Radford Land & Improvement Company to erect a dam across New River (marked Government

Exhibit No. 275) the concluding paragraph being pertinent: "And in the erection and maintenance of said dam, when required by the said New River Steamboat Company, after the said New River Steamboat Company has provided a steamboat for its purposes, ready for operation, then the said Radford Land & Improvement Company shall provide and maintain a suitable lock which will allow the passage of a boat of the capacity of 60 feet long by 15 feet wide. This is an Act of the General Assembly of Virginia, Section 1887–8.

By Mr. JACKSON. I understand these are being received as Exhibits and I ask that our exception be noted.

By Mr. JONES. This is an Act that relates to Montgomery and Pulaski Counties. I desire to call the Court's attention to this Act, approved March 24, 1926, of the Acts of 1926: "Be it enacted by the General Assembly of Virginia that the owners of land in Montgomery and Pulaski Counties, Virginia, below the mouth of Little River, abutting on and adjacent on New River, and the owners of the coal and other minerals in and under such land, be, and they are hereby given the right and privilege of mining and removing, and of having mined and removed the coal and other minerals under New River, lying opposite their respective lands to the center of the stream, but nothing in this Act shall be construed to affect the vested rights of any citizen or citizens of Virginia, natural or artificial." This is from the Acts of Assembly 1926, page 659, being Chapter 366.

By Mr. JACKSON. May our exception be noted to the receipt of this?

By Mr. JACKSON. In exhibit 271 that was just offered I think it is sufficiently clear from what was read that the relator said the
attention of the Board of Public Works is especially called
2900 to the fact that in expending Federal Funds for this project,
approval of both the Federal Power Commission and the State Corporation Commission will no doubt have to be obtained.

By the COURT. That is Mr. Draper's letter.

By Mr. JACKSON. In that connection, I offer in evidence from the supplemental appendix to Plaintiff's Brief in this case, Executive Order No. 6251, appearing on Pages 290 and 291 in which the President designates the Federal Power Commission as the agency to examine projects for which money is being loaned under the National Industrial Recovery Act for the Development and Utilization of electric power, regardless of where it is, and without reading it,——

By Mr. THOMPSON. As usual, he doesn't read it all. He left out the statement about submitting it to the Chief of Engineers.

By Mr. JACKSON. Let it be copied into the record without reading it, and it may be marked Defendant's Exhibit No. 611.

*Defendant's exhibit No. 611*

"Executive Order No. 6251. Designating the Federal Power Commission as an agency to aid the Federal Emergency Administrator of Public Works.

Pursuant to authority vested in me by Title II of the National Industrial Recovery Act, approved June 16, 1933, I hereby designate the Federal Power Commission as an agency to aid the Federal Emergency Administration of Public Works in the preparation of that part of the comprehensive program of public works provided for in Section 202 of the Act which pertains to the development of water power and the transmission of electrical energy. As such agency, the Commission shall make a survey of the water resources, of the United States as they relate to the conservation, development, control and utilization of water power; of the relation of water power to other industries and to interstate and foreign commerce; and of the transmission of electrical energy in the United States, and its distribution to consumers, and on the basis of this survey, shall formulate a program of public works.

2900-A "2. I further authorize and direct the Commission to investigate, upon the request of the Federal Emergency Administrator of Public Works, application for loans to be made under Title II of the National Industrial Recovery Act for the construction of the public works projects which involve the development and utilization of electric power and to make recommendations with respect thereto to the Administrator.

"3. The Commission shall authority to appoint, without regard to the civil service laws, such officers, experts, and employees as it may find necessary to carry out its functions under this order, to prescribe their authorities, duties, responsibilities and tenure, and, without regard to the classification Act 1923, as amended, to fix their compensation. The Commission shall have authority also to make all necessary expenditures (including expenditures for personal services and rent at the seat of government or elsewhere, for law books and books of reference and for paper, printing, and binding).

"4. The total expenditures by the Commission in connection with its functions and duties under this order shall not exceed the sum of four hundred thousand dollars ($400,000.00).

"FRANKLIN D. ROOSEVELT.

"THE WHITE HOUSE, *August 19, 1933.*"

By Mr. JACKSON. I have about five or ten minutes of rebuttal testimony.

By the COURT. From whom?

By Mr. JACKSON. Dr. Thomas.

By the COURT. I think you feel, having had him here all the time, you want to put him on the stand, and yet I don't see that there is anything he has to rebut.

By Mr. JACKSON. I am going to have him rebut the statement that he had left out something from his model, or something like that.

By Mr. THOMPSON. I object.

By Mr. JACKSON. I understood from Your Honor that we ought no to take the time of the Court.

By the COURT. I don't think so.

2901 *Government exhibit No. 1*

Map of New River (Original Exhibit)

2903 *Government exhibits Nos. 2 to 13, inc.*

Photographs of bateaux and other types of boats on New River. (Original Exhibits.)

Exhibits Nos. 12 and 13 were not offered in evidence, but, with the consent of the defendant, are treated as though they had been admitted over the objection of the defendant, as being immaterial, irrelevant and incompetent.

*Government exhibits Nos. 16 to 26, inc.*

Physician's certificates pertaining to certain witnesses for plaintiff. (Omitted.)

*Government exhibits Nos. 27 to 29, inc.*

Day books and Ledger of Lilly Lumber Company. (Omitted.)

*Government exhibit No. 30*

Photostat copy "Index to Reports, Chief of Engineers, U. S. Army, 1866–1912." (Original Exhibit.)

2904 *Government exhibit 31*

43d Congress, 1st Session. House of Representatives. Ex. Doc. 1, Part 2.

(pp. 52–64)

REPORT OF THE SECRETARY OF WAR

Being part of the message and documents communicated to the two Houses of Congress at the beginning of the first session of the Forty-Third Congress. Volume II. Washington: Government Printing Office. 1873.

2905. From Ex. Doc No. 25, 42d Cong., 3d Sess.



EXAMINATION AND SURVEY OF NEW RIVER FROM THE MOUTH OF GREENBRIAR, WEST VIRGINIA, TO THE LEAD MINES IN WHITE COUNTY, VIRGINIA.

UNITED STATES ENGINEER OFFICE,
BALTIMORE, MD., *December 20, 1872.*

GENERAL: The appropriation bill of June 10, 1872, for rivers and harbors, required that an examination or survey be made of New River from the mouth of the Greenbrier, in West Virginia, to the lead mines in Wythe County, Virginia.

The field work was executed in August 1872, by Mr. N. H. Hutton, assistant engineer. His preliminary report is inclosed herewith, as well as a report from Mr. C. R. Boyd, a civil engineer attached to Mr. Hutton's party, to both of which attention is recommended.

The country through which New River flows is represented as being very beautiful, fertile, and salubrious. Its mineral resources are extraordinary, its water-power admirable, and its excellence for farming and grazing purposes is admitted by all who have seen it. Such a country deserves development, and it appears that attention was very early directed to it.

A survey of 54 miles of the river between Sinking Creek and Greenbrier River was made by Moore and Briggs in 1819, under the auspices of the board of public works of the State of Virginia, with a view of connecting the waters of the James and Kanawha Rivers by that route.

Their report is interesting and instructive. They say:

"This is truly a noble river. Notwithstanding it was represented to us as being remarkably low, yet it afforded (July 1819) a superabundance of water for every purpose of internal navigation. The fall in this part of the river, considering the mountainous country it passes through, is comparatively moderate. The principal falls are the Bull Falls, McDaniel's, Anderson's, Wiley's, Neilley's, and Peter's Mountain Falls—none of which have been improved in the least degree, yet we ascended them all with our boat, though in two or three instances with considerable difficulty, after taking out our baggage, stores, &c."

It is probable the difficulty of passing their boat was due more to the rapidity of the current than to want of water. They had previously stated the draught of their boat to be 9 inches. They give an estimate of the cost of good sluice navigation of 2 feet at

all times for this portion of the river, $10,400. It must be
2906 remembered that this estimate was made more than fifty years ago, and should now be increased to $30,000, to accomplish the same result on the part of the river (54 miles) between Sinking Creek and Greenbrier; and to $100,000, including the portion from the lead mines to the Greenbrier, 128 miles, with the understanding that the improvement at Foster's Falls be restricted to a sluice-way and tracking-path.

But little has been done in the way of improving the river since the time of Moore and Briggs, though an effort is said to have been made in that direction by the confederate government during the late war. Mr. Hutton states that the keelboats now used draw about 12 inches when two-thirds loaded. By the construction of slight deflectors or dams of rock and brush, both of which materials abound, the volume of the water may be concentrated and the depth over the shoals increased from the present average of about 12 inches to about 2 feet, without too much increase of velocity of current. Some of the falls, which are almost always vertical and of an average height of about 4 feet, could be greatly improved by blasting sluices through them, about 30 feet in width, and of an average length of 50 feet. It is to be observed that the falls have in many cases natural chutes or sluices through them, susceptible, also, of such improvement as that just indicated.

What has been said above refers to a keel-boat navigation, but the pressure for the improvement of this river is increased by the development of the railroads which intersect it and afford the means of rapid transport east and west for the commodities to be procured along and near the stream. There is a demand for the steam navigation.

Mr. Hutton estimates that to give depth of water of 3 feet at all seasons, would suffice for present needs, and would cost $750,000, with only so much reduction of grade at the falls and rapids as would permit small stern-wheel steamers to ascend, each with one or two barges in tow, and probably requiring at a few places that the ascent be made by hauling on ropes attached to fixed points above and to the drum of the steam-engine of the boat. The
2907 improvement contemplated in the above estimate is of the same general character as that referred to above for the 2 feet navigation, except at Foster's Falls, where a lateral canal, if steam is used, seems to be required, at least over the first fall of 18 feet in one-half mile. This canal at a single point would consume in its construction about one-third of the sum mentioned above, $750,000. It is probable that further study of the river and revision of the estimates may enable them to be reduced, at the same time demonstrating the propriety of concentrating the first efforts to improve on certain parts of the river contiguous to exist-

ing lateral outlets. Should Congress not think proper to appropriate a large sum for New River at this time, it is to be observed that the judicious use of any small sum, even a few thousand dollars, would decidedly and at once ameliorate the navigation, while the work done would be available for any further improvement to be subsequently undertaken. It is desired to revise the estimates and to make some additional studies from the maps. A supplemental report will be shortly made, with which the maps and revised estimates will be submitted.

Very respectfully, your obedient servant,

WM. P. CRAIGHILL,
*Major of Engineers.*

Brigadier-General A. A. HUMPHREYS,
*Chief of Engineers, U. S. A., Washington, D. C.*

BALTIMORE, *December, 17, 1872.*

SIR: I have the honor to submit the following preliminary report of the survey of New River, Virginia, made under your direction during last summer.

The portion of the river embraced within the limits of the survey extended from the lead mines in Wythe County to the mouth of the Greenbrier River, a distance, by the course of the river, of 128 miles.

Of this section no previous examination was known to have been made, except of the lower 54 miles, from the Greenbrier to Sinking Creek, which was surveyed and leveled by Messrs. Moore and Briggs in 1819.

The party was organized and equipped at Wytheville, 2908 the county-seat of Wythe County, and about 15 miles from our starting point on New River. Operations were commenced on the 2?th of July, at the dam of the Wythe Union Lead Company, and terminated on the 21st of August at the mouth of the Greenbrier River.

From the lead mines to the eighty-third mile, level and compass lines were run, determining the meanderings of the river, the slope of the water-surface, and the form and extent of the obstructions. Cross-sections of the river were also taken at frequent intervals, and an accurate topographical sketch of the valley.

At the eighty-third mile, owing to a sudden rise in the river of considerable extent (between 4 and 6 feet) which rendered the further immediate prosecution of the levels impracticable, the major portion of the party was disbanded, and the examination of the river thence to the Greenbrier was confined to a personal examination of the rapids and shoals, with topographical sketches of the country.

This course was rendered more evidently the proper one, under the circumstances, from the fact that, as before stated, this portion of the river had already been surveyed and leveled; and for the 14 miles that this survey overlapped the survey of Moore and Briggs, an almost perfect coincidence was observed to exist.

New River which forms the main body of that stream which, after the junction of the New and Gauley Rivers, is known as the Kanawha, rises in the northwestern corner of North Carolina, near the Tennessee line, and flows northeasterly through and between spurs and branches of the Blue Ridge until it reaches the initial point of this survey, at the lead mines. From this point it flows in the same general northeasterly direction, between and parallel to the main divides of the Blue Ridge and the Alleghanies, cutting alternately through spurs, from the one or the other, until, in the fifty-fifth mile of the survey, at what is known as the Horseshoe, it turns abruptly to the northwest and breaks through the five ranges into which the Alleghanies are here divided, keeping the same direction to the Greenbrier, 73 miles beyond.

2909 Throughout this whole distance the valley almost always presents some level bottom-land, though nowhere except in the Horseshoe could it be considered at all extensive. The foot-hills, however, that border the river are fertile to their summits, and good timber abounds.

Commencing at the lead mines with a width of 350 feet and an average depth of 5 feet, the river gradually expands to a width of 900 feet and an average depth of 6 feet, just above the Greenbrier, subject, of course, to the occasional expansions and contractions found in all natural water courses.

On its course, between the mines and the Greenbrier, New River receives several tributaries of no inconsiderable size. Among them, in the east, are Big Reed Island and Big Stony Creeks and Little and Indian Rivers; on the west, Cripple Reed, Walker's, and Wolf Creeks and East and Blue Stone Rivers. All of these are mountain streams, furnishing from 50 to 200 cubic feet per second of water at ordinary stages.

The drainage area of the river, within the limits of the survey, amounts to 2,400 square miles.

During the time of this survey the river was in rather an unusually low condition, according to the opinion of all the residents along its borders; yet the results of slope measurements and cross-sections at various points indicated a discharge of 2,000 cubic feet per second at the lead mines, and 3,000 cubic feet above Lipford's Falls, in the sixty-second mile.

From this it will be perceived that this stream affords at all seasons an abundance of water for any scheme of navigation improvement that may be adopted.

The river in its present condition presents the usual features of mountain streams: reaches of comparatively still and deep water separated by rapids and shoals.

In the upper portion of the river, for 35 or 40 miles, the pools are generally very short, whole miles being composed of ledges of slate or limestone, 200 or 300 feet apart, with small pools between. In the lower portion, though the rapids are more concentrated, yet even there the pools will hardly average more than one mile in length.

2910 The total fall of the river from the lead mines to Greenbrier is 531 feet, or about 4¼ feet per mile—a grade that, if equally distributed throughout, would offer no impediment to such navigation as the country along the river has need of.

The obstructions to navigation are of three kinds:

Ledges over which the water falls;

Ledges that simply cut across the axis of river, without effecting any change of slope of water-surface; and

Ledges formed by bowlders and gravel brought down by freshets.

The ledges encountered along the upper half of this section of the river are almost entirely of slate, while those found for 40 miles below are of limestone, and the remainder, toward the lower end, of sandstone.

All of these deposits are distorted and upheaved to such an extent that in most of the ledges the strata are nearly vertical, and, with one or two exceptions, where trapdikes appear, will be comparatively easy of removal by blasting.

The following statement of the obstructions encountered in each mile will probably assist in forming a correct view of the difficulties to be overcome, as well as the best method of doing so. It will be understood that in each mile, except to the extent named, the river affords a good navigation and an average depth of 5 feet at low-water stages.

Commencing at the lead mines:

1st mile: Good navigation; fall, 5 feet.

2d mile: Good navigation; fall, 4 feet.

3d mile: One shoal over slate ledges 500 feet long; fall 2½ feet.

4th mile: One shoal 600 feet long; fall, 2 feet 7 inches; and one 400 feet long, fall 1 foot 11 inches; and one sharp-edged ledge, no fall, 100 feet below last shoal.

5th mile: Good navigation.

6th mile: Foster's Falls; about 18 feet fall over slate and limestone ledges, in 2,300 feet, with a short pool and a succession of ledges.

2911 7th mile: Small pools, falling 8 feet in 32 feet.

8th mile: One or two small ledges to be removed; fall, 4 feet.

9th mile: Commerce with a fall of 3 feet in 400 over slate ledges.

10th mile: One rapid 600 feet long; fall, 7 feet.

11th mile: Good water.

12th mile: One small ledge 50 feet wide.

13th mile: Good water.

14th and 15th miles: Consist of shoal rapids for 9,000 feet, falling over sixteen ledges of shale and limestone, about 12 feet vertical.

16th mile: Good water.

17th mile: A succession of nine ledges, 2,000 feet over all; fall, 5 feet.

18th mile: One small ledge, fall, 5/10 foot.

19th mile: Fall of 1½ feet over ledges of shale for 300 feet.

20th mile: One ledge 200 feet wide, and one 20 feet wide; fall, 3 feet over both.

21st mile: Four ledges, each 50 feet wide; 6 feet fall over all.

22d mile: Five ledges; fall over all, 8 feet.

23d mile: Wide and shoal; river falls over six ledges; will require some work the whole distance; fall, 9 feet.

24th mile: River narrowing, but still falling over ledges of limestone and shale; about six ledges crossed; 7½ feet fall.

25th mile: Allison's Falls occur at the beginning of this mile, where the river falls 3 feet in 300 feet over a ledge of red shale.

26th mile: Good water, except some slight clearing away of bowlders; fall, 1 foot.

27th mile: River wide and filled with islands, among which the river falls 13 feet over four ledges; will require excavation for 2,500 feet.

28th mile: Good water; fall, 3 feet.

29th mile: River falls 8 feet over a succession of nine ledges of shale.

30th mile: One ledge 800 feet wide, one 300 feet; fall over all, 3 feet.

2912 31st mile: Wysor's Falls, where river falls 7 feet over two sets of ledges, both about 800 feet wide.

32d mile: Four ledges, each about 100 feet wide; fall, 10 feet.

33d mile: Commences with fall of 5 feet over five ledges, about 50 feet wide each.

34th mile: Good water; fall, .2 foot.

35th mile: Good water; fall, 2 feet.
36th mile: One ledge, 250 feet wide; fall, 2 feet.
37th mile: Two ledges, each about 200 feet wide; fall, 3½ feet.
38th mile: Commences with continuous ledges for 1,600 feet; fall, 3 feet.
39th mile: Good water.
40th mile: Good water; fall, 1 foot.
41st mile: Ledge of gray shale at lower end, falling 3 feet in 800 feet.
42d mile: Continuation of same shoal rapids for 1,500 feet; fall, 4 feet.
43d mile: Rapid shoals over bowlders and gravel for 1,000 feet, and then one narrow ledge with 4/10 foot fall.
44th mile: Two riffles over bowlders and gravel, about 100 feet in both; fall, 2 feet.
45th mile: Seven ledges; fall, 7 feet in 1,000 feet.
46th mile: Good water; fall, .5 foot.
47th mile: Two ledges, about 500 feet over both; fall, 4 feet.
48th mile: Shoal of bowlders and gravel, 500 feet long; fall, 1 foot.
49th mile: Rapids and shoals (mostly over bowlders) 2,000 feet long; fall, 4 feet.
50th mile: Good water; fall, 3 feet.
51st mile: Rapid, over bowlders and gravel, 1,500 feet long; fall, 8½ feet.
52d mile: Three narrow submerged ledges, 30 feet in all; fall, 1 foot.
2913 53d mile: At lower end Barnitz Falls, over five ledges of limestone 450 feet; over all fall, 6 feet.
54th mile: Shoal and rapid over boulders and gravel 800 feet long; fall, 4 feet. In this mile a portion of the river is said to sink and pass underground across the "Horseshoe Bend," reappearing in the 59th mile in the form of powerful springs, discharging water of about same temperature as that of the river.
55th mile: Good water; a few bowlders to remove; fall, .5 foot.
56th mile: Two ledges very narrow; fall, .5 foot.
57th mile: Good water; fall, .5 foot.
58th mile: Good water; fall, .5 foot.
59th mile: Shoals over bowlders, &c., 800 feet long; fall, 2 feet.
60th mile: Good water; fall, .5 foot.
61st mile: Good water; fall, .4 foot.
62d mile: Good water; fall, .4 foot.
63d mile: Good water; fall, .4 foot.
64th mile: At lower end commences Sifford's Shoals, with fall of 2 feet over slate ledges 500 feet wide.

65th mile: Continuation of Sifford's Shoals; river very wide and shallow; fall, 10 feet, over slate ledges about 200 feet apart, with 3 feet water between them.

66th mile: The same; fall, 9 feet.

67th mile: Shoals continue for 1,600 feet; then a short pool and Walker's Mount Falls, where the river falls 5 feet in 500 feet, over two ledges of shale and metamorphic limestone.

68th mile: Continuous ledges for 4,000 feet; fall, 8 feet. In this mile a subterranean stream discharges into the river from under left bank. The sound of a waterfall could be heard from under the rocks over which the line of survey passed.

69th mile: Good water; fall, 3 feet.

70th mile: Four ledges, extending over 1,000 feet, with a fall of 6 feet.

2914 71st mile: Good water; river very narrow and deep.

72d mile: One shoal over bowlders and gravel, 1,000 feet long; fall, 2 feet.

73d mile: One shoal, 1,500 feet long, over bowlders and gravel.

74th mile: Snidow's Falls, 2,000 feet in length, over bowlders and gravel; fall, 5 feet.

75th mile: One ledge of limestone, 300 feet long; fall, 3 feet.

76th mile: Four submerged reefs, about 50 feet in all; fall, .75 foot.

77th mile: One riffle over bowlders and gravel, 1,000 feet long.

78th mile: Rapids, 500 feet long, over bowlders and gravel; fall, 2 feet.

79th mile: Rapid over two ledges, 500 feet long; fall, 7 feet; swift water whole mile. In this mile a subterranean stream discharges into the river from under the right bank.

80th mile: Five ledges, 50 feet over all; swift water whole mile; fall, 7 feet.

81st mile: One rapid, 300 feet long, over bowlders and gravel; fall, 3 feet.

82d mile: One rapid over large rocks, apparently loose, bowlders and gravel, 500 feet long; fall, 3 feet.

83d mile: Rapid over four or five ledges, 200 feet over all, and lower down another 1,000 feet long, over rocks and pebbles; fall, 5 feet.

84th mile: Swift water; fall, 7 feet.

85th mile: Good water.

86th mile: At French's mill-dam is fall of 5 feet, over four limestone ledges, extending 1,200 feet.

87th mile: One small ledge; fall, 8 feet.

88th mile: One ledge, 100 feet wide, but can be avoided by going behind island and removal of 300 to 400 feet of gravel bar; fall, 3⅓ feet.

89th mile: Shoal over bowlders and gravel, 500 feet long; fall, — feet.

2915 90th mile: Shoal over loose rocks, 100 feet long; fall 3 feet.

91st mile: Good water.

92d mile. Peter's Mountain Falls, where river falls 4½ feet in 1,300 feet, over a succession of limestone ledges, terminating in an abrupt fall of 5 feet.

93d mile: Two ledges, ten feet wide each; fall, 3 feet.

94th mile: One shoal over bowlders and gravel, 500 feet long; fall, 3 feet.

95th mile: One shoal of bowlders and gravel, 1,500 feet long, containing three ledges of rock; fall, 5 feet.

96th mile: Good water; fall, 1 foot.

97th mile: Good water; fall, 4 feet.

98th mile: One long shoal of bowlders and gravel for 1,500 feet, traversed by one ledge of rock with 2½ feet fall over it; whole fall, 6½ feet.

99th mile: Good water; fall, 1 foot.

100th mile: Neilley's Falls and rapids; whole fall, 11 feet, 6 of it nearly vertical. A sluice 500 feet long, along left bank, will pass them, with 50 feet of rock excavation and 450 feet of bowlders and gravel.

101st mile: Commences with shoal, 600 feet long, over bowlders and gravel; fall, — feet.

102d mile: One riffle over bowlders, 100 feet long; fall, 2 feet.

103d mile: One riffle, 500 feet long, over bowlders and gravel; fall, 3.8 feet.

104th mile: Commences with shallow riffle, 600 feet long, over bowlders and gravel, and following this occurs Wiley's Falls, where the river falls 4 feet in 10 feet, over a limestone ledge about 50 feet wide.

105th mile: Riffle and shoal, 1,600 feet long, over bowlders and gravel, with four ledges of rock, which can be turned, however, by passing along right bank, through loose rock and gravel; fall, 5 feet.

2916 106th mile: One narrow ledge; fall, 2½ feet.

107th mile: A few loose rocks only; fall 3¾ feet.

108th mile: Riffles over pebbles for 200 feet; fall, 4¾ feet.

109th mile: Swift water and riffles over bowlders for three-fourths of a mile, terminating with a fall of 3 feet over a limestone ledge 200 feet wide; several large detached rocks below falls.

110th mile: Two falls over limestone ledges, each 2 feet in 250 feet; fall, 4¾ feet.

111th mile: Three ledges, 500 feet over all; fall, 2.4 feet.

112th mile: McDaniel's falls, ledge 300 feet long; fall, 4 feet.

113th mile: Good water; fall, .4 foot.

114th mile: Rapids and shoals over continuous ledges for 1,000 feet; about 300 feet of rock excavation; fall, 3 feet.

115th mile: Good water; fall, 1.4 feet.

116th mile: Good water; fall, 1 foot.

117th mile: Two small ledges, 35 feet in both, and 150 feet of shoals over pebbles and bowlders; fall, 2.3 feet.

118th mile: One rapid and shoal 1,000 feet long, over continuous ledges; fall, 8½ feet.

119th mile: Bull Falls, ledge 3 feet high; blasting for 100 feet, and rapids 300 feet long below, over pebble and bowlders.

120th mile: Four ledges 250 feet long over all, ending fall of 3 feet over a ledge 20 feet thick.

121st mile: Three ledges, and rapids for 500 feet over loose rock and gravel; fall, 1 foot.

122d mile: Shoal over gravel, 1,000 feet long; fall, 3 feet.

123d mile: Good water; fall, .22 foot.

124th mile: Shoals and rapids, crossed by seven or eight ledges, extending 1,000 feet; fall, 6¾ feet.

125th mile: About 3,000 feet in length of shallow rapids over bowlders and gravel.

126th mile: One rapid 500 feet long, crossed by two ledges of rock; fall, 2.25 feet.

2917 127th mile: Good water.

128th mile: Ends with three-fourths of a mile of rapids; shoals over ledges of sandstone. To connect with Greenbrier would be necessary to canalize behind islands; fall, 7 feet.

The results of the survey are not yet sufficiently arranged and developed to enable me to present an exhaustive review of the subject of the improvement of this river, but it may be said generally that the object of the improvement, as expressed by the promoters of the scheme, is to connect the iron, lead, and zinc deposits of Wythe County and the copper of Carroll with the coal of the Kanawha fields.

The region traversed by New River, through the counties of Wythe, Pulaski, Montgomery, Giles, Mercer, and Monroe, is one of the most fertile in Virginia, notwithstanding its general mountainous character.

Carroll and Wythe Counties abound in rich deposits of copper, iron, lead, zinc, and manganese, which are yet hardly developed, owing to the want of economic means of transport, though there are now in operation, within a length of 20 miles along the river, nine iron furnaces, and the Wythe Union Lead Mines, which have been worked for more than a century, and still yield abundantly of lead and zinc ores of great purity.

These counties, as well as those before named, farther down the river, possess fertile soils and abundance of good timber. The whole region is remarkably well adapted to sheep-raising; and it can hardly be doubted that the immense water-powers existing all along this river and its tributaries would be utilized for woolen and other manufacturing operations, if an outlet were offered to a market.

The improvement, if effected, would, in about 40 miles below the lead mines, intersect the Virginia and Tennessee Railroad and the Chesapeake and Ohio at the mouth of the Greenbrier, thus opening to both eastern and western markets a large area of productive country, now practically shut up.

The present wants of this region would be met by any system of improvement which would afford 3 feet depth of water
2918 during the lower stages of the river. With only so much reduction of grade at the falls and rapids as would permit a small stern-wheel steamer to ascend with two barges in tow, even if at a few points, the ascent required to be made by hauling up by ropes attached to fixed points above and to the drum of the steamboat engine.

This extent of improvement can be accomplished, except at Foster's Falls, by clearing out sluiceways through the shoals and rapids, at nearly their natural grades, and by opening through the vertical falls and ledges sluices with a slope not exceeding 1 to 10; and all work done upon this place would be available toward the completion of a more thorough and complete system.

At Foster's Falls a lateral canal, at least over the first fall of 18 feet, would seem to be essential.

An approximate estimate of cost for this work would be—

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|---|---|
| 60,000 yards rock excavation, at $2.50 | 150,000 |
| 350,000 yards removal of loose rock and bowlders, at $1 | 350,000 |
| 50,000 yards rock in wing-dams, at $1 | 50,000 |
| Canal around Foster's with two locks, 9-foot lift | 200,000 |
| Total | 750,000 |

The present system of transportation on this portion of the river is by keelboats which carry from two to three tons, and are rowed or floated down the river and poled up. An expenditure of $100,000 would greatly ameliorate the condition of the river for this trade, and enable the trips to be made with so much more certainty as to induce a considerable increase of trade.

In conclusion I would say that, owing to occupation in other duties during the working season just closed, I have been unable to give this subject the attention it requires, and that, on a subsequent and more complete review of the results of the survey, some of the views and figures here presented may be considerably modified.

With this I would also submit the report of Mr. C. R. Boyd, civil engineer of Wytheville, Virginia, on the extent and
2919 character of the resources of the country traversed by the New River, and dependent, to a greater or less extent, for their full development on the improvement of its navigation.

Mr. Boyd has given much of his time to a study of the mineralogy of this region, and is peculiarly well fitted to write upon the subject intrusted to him.

I am also indebted to Mr. Boyd for his valuable professional assistance in the execution of the survey; and my acknowledgments are due Mr. F. Dielman, topographer, and Mr. Charles Humphreys, surveyor, for the very efficient performance of their respective duties.

Respectfully submitted.

N. H. HUTTON, *Assistant.*

Colonel W. P. CRAIGHILL,
*Corps of Engineers, United States Army.*

2919A WYTHEVILLE, VIRGINIA, *December 17, 1872.*

SIR: In compliance with instructions to collect and forward data bearing upon the value of the improvement of New River to the adjacent country, I have the honor to submit the following report, together with a map illustrative of the country treated of. At the same time I would ask indulgence for the omission of much important information, which the time and means at command would not permit me to procure.

Assuming that the mineral interests of the country tributary to New River are, or will be, of paramount importance, I have devoted the body of this report to that subject.

That section of country contiguous to and likely to supply tonnage at once to a New River improvement, beginning at its southwestern limit, is the following: A part of the counties of Ashe, Alleghany, and Surry, in North Carolina; parts of the counties of Carroll, Grayson, Wythe, Pulaski, Montgomery, Bland, Tazewell, and Giles, in Virginia; and the counties of Mercer, Monroe, and Summers, in West Virginia; comprising an area filled with apparently inexhaustible deposits of iron-ore of high grade, coal, lead, zinc, copper, baryta, salt, alumina, sandstone, (millstone and grindstone grit,) limestone, (both ordinary and magnesian,) and sometimes strong indications of beds of gypsum, some of which leads of ore are exhibited nearly in their actual position upon the accompanying map.

About the counties of Ashe, Surrey, and Alleghany, in North Carolina, I know but little, except that greater facilities than they have yet enjoyed for transportation will greatly stimulate the raising of copper ores from mines now idle (so distant are

the smelting establishments,) as well as the production of cereals, dried fruits, cranberries, tobacco, &c., for which they are noted.

The counties of Grayson and Carroll in Virginia, lying between diverging ridges of the Blue Ridge and Alleghany Mountains, and essentially mountainous in physical structure, are watered by New River and tributaries, having a good native soil, and often showing their highest ridges in cultivation to their summits.

Their large deposits of copper and iron have long since induced enterprising men, of their own and neighboring counties, to devote capital and time to the raising of ores to find themselves prohibited from realizing a safe return by the imperfect means of transportation.

The copper and accompanying arsenate of iron, showing conspicuously three miles southwest from Hillville, the county site of Carroll County, have been traced southwardly to Duck Town, in Monroe County, Tennessee.

The kinds of copper ore given by Dr. Dickeson, geologist, of Philadelphia, are the red oxide, 63.04 per cent.; black oxide, 54.02 per cent.; smut, 25.12 per cent., from good ores in the Dalton mines; giving an average from good and bad of 32 per cent. of metallic copper.

The vein seems to have a trend S. 28° E., (no doubt variable on the lead;) dip tending to vertical, with a width seldom diminishing below 8 feet. The water-power of these, like that of all the other counties treated of in this report, would be decided, upon close inspection in the driest weather they experience, as very good, inasmuch as but few of the whole number of streams become dry in any season. Their agriculture is improving, and would, under more favorable circumstances, send large supplies of grain to market.

The trade in horses, cattle, hogs, sheep, wool, leather, tobacco, cranberries, fine apples, dried fruits, &c., is now a matter of much local interest.

The counties of Wythe, Pulaski, and Montgomery, lying pretty much between parallel ridges of the Alleghanies, are chiefly drained by New River and its tributaries. Their physical structure is that of a plane of broken surface, declining toward the New River basin, presenting in many localities broad areas of gently-rolling lands, covered with either a luxuriant sod of grass, and supporting large herds of beautiful cattle, or with cereal crops, which the fine limestone substratum enables them to produce abundantly.

From the head of Cripple Creek, in Wythe County, extending north by east along the creek, crossing New River, and extending through the southern portion of Pulaski and Montgomery Coun-

ties, is a great lead of iron ore, as represented on the map,
2419B varying in breadth, as shown by its furnaces and forges,
from half a mile to two miles, sending off now and then arms but little less extensive than the main lead, giving the capital and labor invested along it remunerative returns, although the imperfect means of transportation for metal and supplies would appear to be prohibitory. This lead, as developed at Radford iron-works on Mack's Creek, Pulaski County, trending N. 86° E. for seven miles, dip 30° southwestwardly, shows two immense veins of stratified iron ore, between a roof and floor of slate, whose least thicknesses are respectively six and nine feet. No doubt the loose ores worked to the southwest, in Wythe County, are decrepitated from these veins lying hidden under the débris of the mountains southwestwardly from the furnaces and forges of Messrs. Graham, McGavock, Howard, and Saunders, Painter, Pearce, Chatwell, Huddle, Gallup, Crockett & Sanders, and Sayers & Oglesy. This lead has given from its lease valuable ores an assay of 50 per cent. of metallic iron. It may be as well to call attention to the fact that branches of this lead are to be found lapping around both sides of Lick Mountain, Draper's, and the Roaring Falls Mountains in Wythe County, as well as that part of the Draper's Mountain in Pulaski, where an assay of the iron ore has given 87 per cent. of metal. The same, as to branching leads, may be said of many mountain spurs and ridges on the south side of Montgomery County.

The furnaces and forges above enumerated are now shipping 12,000 tons of metal annually, with a supply of charcoal timber so greatly diminished as to cause many of the proprietors to look abroad rather anxiously for supplies of stone-coal or coke.

The lead and zinc ores of these counties accompany each other throughout a great part of the distance traversed by either, having a course nearly parallel with the iron.

The Union lead mines, in Wythe County, have been worked for more than a century, giving a great part of the metal that was used by the colonists in the Revolutionary war, and supplying nine-tenths of the lead consumed by the confederates in the late war. The ores are chiefly carbonates and sulphurets, overlaid by heavy masses of zinc ore, which are mined and shipped north in the crude state. In fact, it seems to be one of the distinctive features of the lead at this point that zinc ore is always superposed upon it. The recent discovery by the company of a vein 50 feet in thickness, renders it an inexhaustible mine. To the southwest tracings of this lead have been found as far as Tennessee. It is distinctly marked twelve miles north by east, and farther than that is either displaced by the zinc ore or lies at a greater depth.

It is highly probable that the lead which shows in remarkably pure masses at Childress's Store, in Montgomery County, bends abruptly to the left along a spur, and outcrops again at Eskridge's at Repper's Ferry, where at one time it was mined and reduced to metal.

The zinc ore to the southwest of and near the mouth of Reed Island Creek, appears near the surface in masses, giving upon assay a percentage which has induced purchases by experienced miners, and it would be extensively worked were a more certain means of transportation provided.

The coal lying toward the northern boundaries of the counties of Montgomery, Pulaski, and Wythe, in the southern slope of a mountain which is most generally known as Cloyd's or Little Walker's Mountain, crossing the river near Lifford's, is variable in the thickness of its measures, showing veins occasionally seven and a half feet in thickness, changing from a nearly pure anthracite to a coal containing nearly 20 percent of bitumen. It has been estimated by experts that ten miles' length on two veins in Montgomery County, above water-level, will yield 850,000 tons; but there are certainly five veins in this lead developed in Wythe County, varying in thickness from an 8-inch seam to a 7½-foot vein, with a strong probability of the existence of three more, which, if they should continue through that portion contiguous to New River, would suggest the idea of a very great quantity both above and below water-level, as it has been found to outcrop at elevations varying from 1 to 600 feet above water-level. Accompanying these measures, both above and below, are veins of valuable iron ore, thinning out and thickening along their extent, in some places well-defined specimens of the hydrated peroxide of iron having been taken from a vein overlying the coal at a short distance, while the veins beneath are more or less hematitic in character, sometimes fossilliferous, as at Tyler's, in Pulaski. The coal has an average trend about north 70 degrees east, average dip southwestwardly 30 degrees, until it reaches that part of Montgomery broken by anticlinal ridges. The most conspicuous openings upon these measures are located near Blacksburgh, in Montgomery County, Tyler's and others, in Pulaski County, and at Stony Fork, in Wythe County, at neither point a greater distance than twenty-five miles from the river. They are now engaging the attention of a continually extending trade. While prosecuting the survey of New River through the gaps made in the mountains by the passage of the river, I saw great masses of white siliceous conglomerate, perhaps 500 feet beneath the coal-veins, and, within that space, good grindstone grit, which has been mined, particularly in Wythe County, for a great many years, not far from which, in the cove of Wythe County, are extensive beds of marble.

Bartya in these counties seems to accompany the leads
2919–c of lead and zinc, pure in some veins, in others discolored by manganese and iron ore, requiring the use of sulphuric acid to force it from its impurities.

Bodies of white-oak timber and pine of various kinds are likely to engage the attention of the shipping interests on the sea-board when transportation shall be more convenient.

The county of Giles, lying on both sides of New River, between great parallel ranges of the Alleghanies, is essentially limestone in geological structure, except in the greater mountains, which are made up of quartzose and siliceous rocks, slates, shales, &c. The soil is superior, being based in the main upon limestone, and is noted for excellent natural grasses, fine herds of cattle, good crops of the cereals, tobacco, &c. Sheep-raising in this, as well as in most southwestern counties, forms a very important item in domestic economy, yielding large quantities of wool for shipment. The iron ore of Giles County is extensive and of excellent quality. Experts have regarded the body of ore upon the Little Flat Top Mountain, lying westwardly from the river, in the Kimberling country, as the largest of good quality known to exist in Virginia. These ores are a fine, dark hematite, of high percentage of metal, located about as represented on the map. The ore showing on slopes of Saltpond Mountain, near Newport, is in large quantity, and turns out, at the works of Mr. Williams, a tough and easily-worked metal. The coal situated toward the western boundary of the county, near the large deposists of iron, needs further investigation to prove its quantity and quality.

The same measures, extending the length of Bland County, have been opened in some places, showing thick veins near Sharon Alum Springs, and a fair quality of coal, which will, no doubt, improve as the mining proceeds. Strong hopes are entertained on Walker's Greek, and in Burk's Garden, that the coal showing in those localities will prove to be in large quantity. This county includes a part of the Little Flat Top Mountain deposit of iron. With that and the iron ore on the northern boundary, it presents masses of metalliferous deposits of great value. The fine bodies of white-oak, pine, walnut, cherry, beech, maple, &c., abounding in this county, will, no doubt, be sought after by ship builders and furniture makers, while nearly equal facilities exist with the other counties for the raising of fine cattle, sheep, and hogs.

Toward the northern boundary of the county of Giles, near the narrows, (Peter's Mountain Falls,) exist ores of either plumbago or dark oxides of some of the finer metals, which need a thorough assay to name them.

Mercer County, West Virginia, between the East River Mountain and the Great Flat Top Mountain, as to its available lands

between East River and Bluestone River, is a plateau elevated 700 or 800 feet above the level of the river, drained in great part by the East River, Bluestone, Lick, and Island Creeks; and as to minerals, is chiefly remarkable for extensive measures of bituminous coal on the southeasterly slope of the Great Flat Top Mountains, extending through the whole of the northwestern side of the county, requiring further development to show number and width of the veins. They, however, outcrop for a distance, directly across their trend, of nearly ten miles; the greatest measure yet developed being an 11-foot vein.

The northern slope of East River Mountain shows considerable deposits of iron ore, ledges of variegated marble, very pure baryta, and fine millstone grit extending along Peter's Mountain into Monroe County. Iron ore does not exist in such masses as in Giles County, but upon Bluestone, above the mouth of Brushy Creek, presents fine bodies of ore, which have yielded, upon assay, from 48 to 80 percent of metal, chiefly lying upon the spurs of the Black Oak Mountains, as well as in ridges and spurs of the Flat Top, upon the opposite side of the Bluestone River. This county is particularly noted, also, for containing large forests of white-oak timber, while its soil is thinner, being generally a sand rock beneath, from which, in places, a fine grindstone grit has been taken. It is sometimes crossed by ledges of limestone, probably magnesia, from which good lime has been made.

Monroe is almost entirely limestone in its substratum, has a deeper soil, but, as to minerals, too little is known to venture upon any positive location of the several bodies of fine ore which she is known to possess, except the lead of iron upon Little Mountain, lying next Peter's Mountain, on south boundary, from which metal has been manufactured of good quality.

This county, unlike Mercer County, presents an alternation of ridge and valley, and is one of the best timbered counties in the State.

That part of the county of Summers within reach of a New River improvement is chiefly noted for a fine body of white-pine timber on Bluestone River, beginning near its mouth and extending into Mercer; for evidences of coal measures near Crump's, together with a part of the Great Flat Top measures, and for the salt-wells upon the left bank of New River.

To sum up, a sufficient transportation will throw open to the world great metalliferous deposits, with the extent of which I was scarcely even in part acquainted, until that cursory examination of which this is the report.

The kinds of valuable timber in all these counties are white, red, Spanish, black, post, and pine oaks, black and white walnut,

 poplar, beech, birch, white, yellow, and black pines,

cherry, hickory, sugar-maples, lynn, buckeye, chestnut, and cedar, all of which exist in extensive bodies in various localities within the scope of this report.

A line drawn from Princeton, in Mercer County, east by south, toward the southern boundary of Pulaski, will pass over but little country whose rocks do not dip almost regularly at an average angle of 30 degrees southwestwardly.

The points which would suggest an idea of important geological divisions are, first, in the line of the East River and Peter's Mountains; again, near the coal measures in the gaps of mountains crossing the river just below Lifford's; and, lastly that I have noticed, in the contortions along New River, near to and below Foster's Falls, where appear those red shales and slates, forming for many miles the bed of the river, (easily worked,) classed by some persons as the new red sandstone, while Foster's Falls (just opposite the Roaring Falls Mountain) are composed of quartzose silicates, of earlier formations.

Respectfully submitted.

C. R. BOYD,
*Assistant Engineer.*

Colonel WILLIAM P. CRAIGHILL,
*Corps of Engineers, U. S. A., Baltimore, Maryland.*

UNITED STATES ENGINEER OFFICE,
*Baltimore, Maryland, January 9, 1873.*

GENERAL: I have the honor to transmit herewith, as supplementary to my report on the survey of New River, Virginia, forwarded on the 20th December, 1872, the following drawings, viz:

Eleven sheets of map of New River, scale 1 inch to 800 feet.

One tracing of map of New River, scale 1 inch to 6,600 feet.

One tracing of profile of New River.

One tracing, showing the location of coal and mineral deposits of region of country drained by New River.

The first-named maps exhibit the meanderings of the stream, its width, and generally its depth, as well as the positions of ledges, shoals, and falls, and the topography of the valley;

The second, which is from a survey made in 1820, by Mr. H. P. Taylor, shows the general outlines of the river on a smaller and more convenient scale;

The third indicates the slope of the water-surface from the lead mines to the Greenbrier; and

2920. The last named shows, in black, the lines of coal deposits, and in brown the location of deposits of iron, zinc, and lead.

On the large-scale maps the proposed dams and locks are shown in red. All shoals, &c., not otherwise marked, are indicated to have sluiceways cut through them.

The general character and extent of the obstructions to navigation in this river were so set forth in the previous report as to render a repetition unnecessary, but in order to clearness now, it may be well to refer to some of the points in that report.

It was there stated that to give a keelboat navigation of 2 feet depth, which would require tracking or towing paths, where the ascent was too steep to permit the use of poles, would cost $100,000. This estimate is not changed by subsequent and more careful study of the maps and profiles.

It was also said that the expenditure of $750,000 would afford a 3-feet navigation for small steamers, provided that at several places they were drawn up the steeper ascent by ropes attached to fixed point above, and that a lateral canal were constructed at Foster's Falls.

More mature reflection, with a study of the results of the survey, induces the conclusion that a steamboat navigation, impeded by the necessity of hauling up the boats over the steeper places, would be unprofitable and unsatisfactory, and that for steam navigation to be efficient such drawbacks must be done away with.

More careful estimates also indicate that by using a less expensive and a nearly equally serviceable method of construction of locks and dams than was contemplated in the former report, the canal around Foster's Falls can be constructed for about $60,000.

It was expected that the river might, with advantage to its discussion and treatment, be divided into several separate sections relating to their respective facilities for improvement and their connections with transverse means of transportation by rail or otherwise. This expectation has not been realized, except
2921 to the extent that that portion of the river lying between the lead mines and the crossing of the Virginia and Tennessee Railroad (a distance of forty-four miles) would seem to be that which deserves the more immediate attention, as being the only outlet for the large mineral productions of the adjacent counties, as well as of those lying along the river beyond and in North Carolina. The lower counties are principally agricultural; the extent and kind of improvement required for the betterment of the river is about the same throughout.

The two plans which, after mature delay, are recommended for consideration are as follows:

A 2-feet keelboat navigation, as explained in the former report, costing $100,000; or a 3-feet steamboat navigation, as set forth below, which would cost $1,000,000.

To expect a navigation for steamboats of light draught, it is assumed that they can for short distances ascend a grade of 1 in 400, with a current of five miles per hour. It is therefore proposed

to excavate a sluiceway 90 feet wide and 3 feet deep through all shoals having a grade not exceeding 1 in 400. Where the grade exceeds this, low regulating dams are proposed, with sluices with a fall not exceeding 1 foot at each. In several cases, as stated below, and indicated on the large map, dams should be introduced containing locks; and in two other places, lateral canals.

The dams and locks may be of crib-work filled with stone, for which an abundance of material is found all along the river. It was not possible with the means at command to determine the exact position and height of dams required, or the precise amount of excavation, but the estimates are believed to be sufficient both as to quantities and prices.

The dams are estimated at an average height of 6 feet, with a width at base of 12 feet. The locks are estimated at 25 feet wide and 90 feet in length, with a depth of 4 feet on the miter-sills, in order to allow for any probable future extension of the depth required by the boats navigating the river.

2922 The estimate for a 3-feet steamboat navigation will be, as explained above:

| | |
|---|---|
| 100,000 yards rock excavation, at $1.50 | $150,000 |
| 500,000 yards gravel and bowlder excavation, at 50 cents | 250,000 |
| 60,000 linear feet of dams, at $5 per foot | 300,000 |
| Two locks, 10-feet lift, at Foster's | 40,000 |
| One lock, 9-feet lift, at Gadby's Ferry | 20,000 |
| One lock, 7-feet lift at English's Ferry | 18,000 |
| One lock, 6-feet lift, at Barnett's Falls | 17,000 |
| Four locks, 7-feet lift, at Lifford's Falls | 72,000 |
| One lock, 10-feet lift, at Peter's Falls | 20,000 |
| One lock, 5-feet lift, at Neilly's Falls | 15,000 |
| One lock, 5-feet lift, at Weilley's Falls | 15,000 |
| | 217,000 |
| 40,000 yards canal prism at Foster's Falls, at 50 cents | 20,000 |
| 160,000 yards canal prism at Lifford's Falls, at 50 cents | 80,000 |
| Total | 1,017,000 |

The portion of river included between the lead mines and the Virginia and Tennessee Railroad will cost to improve, according to this plan, about $350,000, and it would appear, as stated above, that it is the part at present most needing improvement for the development of a valuable interest already existing.

The pools are now capable of navigation by vessels drawing 5½ feet. To give a lock and dam navigation of 5½ feet from the lead mines to the mouth of the Greenbrier would cost about $2,500,000, overcoming a fall of 550 feet in one hundred and twenty-eight miles.

The statement was made in the former report that a comparatively small sum could be expended on this stream with great and immediate benefit to its navigation, which would be useful in the more extended improvement under any plan likely to be
2923 adopted in the future. That opinion is still entertained.

Very respectfully, your obedient servant,

WM. P. CRAIGHILL,
*Major of Engineers.*

Brigadier-General A. A. HUMPHREYS,
*Chief of Engineers, Washington, D. C.*

2924 *Government exhibit 32*

(pp. 3–32; 62–65; 113–114)

Report of Moore and Briggs. Fourth and Fifth Annual Reports of the Board of Public Works to the General Assembly of Virginia (1819). Report of the Principal Engineer of the Board of Public Works.

2924–A REPORT

*To the Board of Public Works for the State of Virginia:*

Having, in the early part of the year, contracted with a manufacturer in Baltimore, for several important instruments, they arrived in Richmond on the 20th of the 3d Mo. last. Asa Moore was appointed as an Assistant on the 24th, and on the 26th, we commenced laying out the Manchester canal, agreeably to the instructions of the Board, of the 12th of the same month. Isaac Briggs having been applied to, by direction of the ex-officio members, to supply the place of additional Engineer, arrived on the 27th, and immediately joined us in the work.

After completing the survey, levelling, and taking notes for estimating the cost of this canal, whilst our boat was fitting up, and other preparations making for our western tour, we were employed in the same kind of operations on the northern side of the James River, between the lower arch and Sabbat Island.

On the 27th of the 4th Month, having completed our preparations, we commenced our journey westward; and, (for reasons which will hereafter appear) as we went up the river, continued our survey for an independent canal, from opposite the lower point of Sabbat Island, to the upper end of Pleasants' Island. We arrived at Lynchburg on the 10th of the 5th Month.

Previous to our leaving Richmond, we were so fortunate as unexpectedly to meet with two more excellent levelling instruments for sale, both of which we secured; one on our own ac-

count, and the other on account of the Board of Works, by direction of the ex-officio members. At Lynchburg, by appointment, we were met by Thomas Mifflin Ladd, another assistant, who brought with him a small theodolite, a very useful and convenient instrument for the necessary field operations in laying out roads. This made our stock of instruments very ample and complete.

At Lynchburg, agreeably to arrangements previously made, another boat was purchased, and delivered to Asa Moore, in order to be fitted up for the purpose of attending him on a sur-
2924–B vey for an independent Canal from that place to the head of Pleasants' Island, and afterwards on other sections higher up the river. This part of the work was confided to him, in consequence of his having had more experience in using the levelling instrument than either of our other assistants. A set of hands was therefore organised as his assistants, and the necessary instructions given him for the execution of the work; which it was our intention to examine on our return from the westward, and to take notes on the ground for the purpose of enabling us to form estimates of the different items of expense incident to the formation of such a canal.

It would seem that some time might have been saved, by commencing the survey for this canal at Dunlap's Creek, (the highest point,) and continuing the same regularly, to its lower termination, instead of first laying out a lower section, and then passing again up the river to a higher; but there were circumstances which rendered the plan adopted the most eligible. One was the difficulty of conducting levelling operations through fields corn, when grown to the height of six feet and upwards. This made it very desirable to have that part of the business which lies in the great corn country between Lynchburg and Richmond, executed as early in the season as possible. Another was, that this part of the line lay entirely on one side of the river, and presented less difficulty than those parts higher up the river, where a greater exercise of judgment would be necessary to determine on the places of crossing, and the choice of grounds for the canal; supposing it possible that either my colleague or myself might be able to return from the mountains in time to conduct at least a part of the survey over these more difficult grounds. A third was, that, as we were apprehensive that the whole of the survey might not be completed in the season, we deemed it expedient to make sure of the lower sections.

After remaining at Lynchburg a few days, for the purpose of making the before-mentioned arrangements, procuring supplies, &c., we continued to ascend the river to the mouth of Craig's creek; Andrew Alexander having joined us by appointment

on our way to this point. In conformity to our instructions on the 24th of the 5th Mo. we commenced the levelling and surveying of that stream, continuing the same up to the mouth of John's Creek, 49 miles, to which place we ascended with our boat. Whilst Isaac Briggs was conducting the early part of this survey, I passed up the valley in which this stream is situated, by way of the road; and from the mouth of John's Creek, across the Alleghany ridge, to the waters of Sinking Creek, thence down the same to New River, with a view to obtain a general knowledge of the country, and to determine on the route for the survey, after leaving Craig's Creek.

2924–C

On this tour, I was very agreeably accompanied by General J. Breckenridge, Major Andrew Hamilton, Major ——— Burwell and Carey Breckenridge.

On my return, I joined my colleague and company, and we continued together as far as the boat ascended the creek, where we found a separation would very much conduce to the despatch of business. And accordingly, Isaac Briggs continued the levelling and survey across the mountain, and down to the mouth of Sinking Creek, on New River; whilst I returned with the boat to James River, and thence up to the same and Jackson's River to the mouth of Dunlap's Creek, where waggons were (with some difficulty) procured to convey the boat, our baggage and stores, across the Alleghany mountain to Greenbrier River, at the mouth of Howard's Creek. Isaac Briggs and company having completed their survey, crossed the country, to the mouth of Dunlap's Creek, from whence a similar survey and levelling was made, to the mouth of Howard's Creek; where the boat had previously arrived, been overhauled, refitted, and launched into Greenbrier River, and waiting their arrival.

On the 21st of the 6th Mo., Isaac Briggs and company commenced the survey and levelling of Greenbrier River. At the same time, Hugh P. Taylor, a young man of our party, possessing talents and industry, and who had previously proved himself qualified for the task, was detached as surveyor of roads, and lines of experiment, incidental to laying out a new road. His first business was to survey the present travelling road or post road, from Greenbrier to the Falls of Kanawha, and the route known by the name of the Gauley route, to the same place, preparatory to their being delineated on a map. Whilst this was going on, I was employed about a week, in company with Josias Shankling, surveyor of Greenbrier county, in examining these two routes, and obtaining a general knowledge of the adjacent country, in order to lay out work for the surveyor in my absence. This being accomplished, and his instructions made out, I returned, and joined the party on the river, on the 29th, near the end of the 37th mile.

The navigation of the Greenbrier river, from the mouth of Howard's Creek to New River, and of the latter, from the mouth of Greenbrier up to Sinking Creek, thence down to Bowyer's Ferry, thence to the Kanawha, and of the Kanawha to its junction with the Ohio, are subjects of interesting consideration; and the proper selection of the modes of improvement, best adapted to the impediments to be overcome, with estimates of the expense, constitute a very important part of our duty. We therefore
2924-D continued together from the 37th mile, on the Greenbrier river, to the mouth of the Kanawha; a tedious, and, in places, extremely perilous journey.

As horsemen can travel from the mouth of the Kanawha to the Falls, in less than half the time that it would require for our boat to ascend the stream, in order to make the best use of time, and to give Isaac Briggs an opportunity of seeing some part of the grounds between the Falls and Greenbrier River, previous arrangements had been made for horses, to meet us at Point Pleasant. The boat returned, with our baggage and men, to the Falls, where it was met by a waggon from Greenbrier county, which had been before engaged to carry our baggage to Jackson's River. Isaac Briggs and myself arrived several days before the boat, and occupied the intermediate time in viewing grounds for the contemplated road. On our way up, we made sale of the boat, to be delivered at the Falls.

Hugh P. Taylor having executed the work laid out for him, met us, by appointment, near the Falls. From an inspection of his maps, and from the want of satisfactory information relative to a large extent of unsettled country, over which a direct line between distant points of the contemplated route would pass, it was deemed advisable to run a direct line between certain points, about 23 miles asunder, through this country, to serve as a guide line in exploring, in case it should appear probable that the route would be improved by making use of grounds near that direction. This was executed whilst the waggon was travelling across the mountains, and Isaac Briggs and myself engaged in viewing other grounds.

On our arrival at Jackson's river, Isaac Briggs commenced the survey for an independent canal, from the mouth of Dunlap's creek downwards; and Hugh P. Taylor returned to his home, in Rockbridge county, for a short time.

Asa Moore having executed his survey below Lynchburg, about the middle of the 7th Month, he had been directed by letter to move up to Wood's Island, about 30 miles above Pattonsburg, and to execute the same kind of survey between those points that he had made below; this part of the line presenting less difficulty than any other of equal length above Lynchburg. He had now nearly finished the survey of this section, and his boat was wanted to

accommodate Isaac Briggs and his party. I therefore rode down, and found him near Pattonsburg, examined a part of his work on the way, and returned with him and his boat to Jackson's River, where he united with Isaac Briggs, in forwarding the survey of the canal.

Hugh P. Taylor returned and met me, by appointment, at Callaghan's, 6 miles west of the mouth of Dunlap's Creek,
2924-E on the 9th of the 9th Mo.; and, on the 10th, commenced the survey of the road, from the mouth of Ogley's creek, by the way of Sweet Springs, Union, Indian Creek, and Pack's Ferry, to the Falls of Kanawha. Whilst this was going on, I spent two days in viewing this route, as far as Indian Creek; then went across to Lewisburg, and explored the grounds, for the purpose of improvement, to the top of Meadow mountain, near the present road; thence near the direct line recently run, so as to be able to direct the survey for the location of the road, on our return.

The survey of the road, by way of Indian Creek, &c. was completed on the 21st; and, on the 22d, we commenced the final location of the new road, and finished on the 13th of the 10th Mo. Hugh P. Taylor then returned home, and I rode down and joined Isaac Briggs on the canal survey, 12 miles above Lynchburg. This survey was completed on the 26th. On the 28th, left Lynchburg, and proceeded to examine Asa Moore's survey to Pleasants' Island, taking notes for estimating the expense of making the canal. We arrived at Richmond on the 10th day of the 11th Mo. 1819.

Having given this rapid historical sketch of the whole of our operations during the late season, I will now proceed to describe the rivers, creeks and land surveys, distinctly, in the order in which these examinations and surveys were made, including estimates of the expense of improving the water courses and making the road, with observations on the individual and relative importance of each; beginning with

### CRAIG'S CREEK

This stream, as will be seen by the map annexed to this report, is remarkably crooked in its course; the valley through which it flows, is considerably sinuous, and may be stated to be from one quarter to two miles in breadth. The stream frequently traversing the valley from side to side, gives a much greater length than a line passing through the middle or on either side of the valley. It measures, from its confluence with James river to the mouth of John's Creek, 49 miles. Its average width for this distance, may be about 55 yards; the whole fall 345 feet, or a small fraction over

feet per mile. The greatest fall in any single mile is 13.33 feet, and but one mill less than three feet.

Very little has ever been done to improve the navigation of this creek. In the year 1818, a small sum was expended in removing a few of the most material obstructions. This sum, I have been told, did not exceed $400; yet even this has rendered it an useful navigation several months in the year.

2024-F I am of the opinion, that a moderate sum, (say) 5 to 6,000 dollars, judiciously expended, would give 18 inches of water, in all places below John's Creek, six months of the year, in usual seasons, and 12 to 15 inches two or three additional months.

We left John's Creek on the 3d of the 6th Month, the water was then said to be unusually low for the season; but if properly collected in sluices, would certainly have given more than 12 inches. The quantity is doubtless at all times amply sufficient for the purpose of supplying a canal. But, by reference to the notes of survey, it will be seen that the very frequent occurrence of high, precipitous, rocky banks, on both sides, precludes the idea of constructing a continued canal on either shore; and the great inconvenience and expense attending the numerous crossings of the creek, added to 345 feet of lockage, forbids the adoption of any plan for making one entirely through the flat ground in the valley, unless some very important benefit was to result from it.

The importance of the navigation of this stream depends very much on the description of improvement which may be adopted on James River. If a good sluice navigation is effectuated in the bed of this river, Craig's Creek will become the channel through which the surplus produce of the valley in which it lies, must find its way to market. Some inducement will also be given to bring some of the adjacent hill sides and smaller vallies into cultivation; so as greatly to increase the quantity of products now raised on its waters. And, if a good road should be made across the Alleghany ridge into the Sinking Creek valley, a part of the products of that district of country would also be invited to pass over to an eastern market.

But, if such a navigation was made down the ravine of the James River, as would reduce the expense of transportation to one-half, or less than half of the price by a sluice navigation, the difference being probably equal to the cost of transportation on a good road from New River, at the mouth of Sinking Creek, to the mouth of John's Creek, the inducements would be great, not only to the inhabitants of Sinking Creek valley, and its immediate vicinity, but also to many, further up New River, to

ansport their most valuable products to the head of the navigation on Craig's Creek, to be thence forwarded to market.

Craig's Creek, above its junction with John's Creek, is too small to admit of improving it for navigable purposes, containing not more than about one-third the water that passes below

And John's Creek, though about double the size, is
2934–G so excessively rapid, that there is as little prospect of improving it for those purposes, in any stage of the water.

The dividing ridge between the waters of Craig's Creek and those of Sinking Creek, is much more elevated than we had been led to suppose. The lowest spot in the ridge is 1,279 feet, above the water, at the mouth of John's Creek. The highest spring, tributary to Craig's Creek, 1,225 feet; and the highest water of Sinking Creek, crossed by the survey, 1,237 feet. This stream was then a small spring branch; its extreme source probably about the same elevation as the lowest part of the dividing ridge. The survey (as will appear by the notes) was conducted partly by the road, and partly in the ravine of the Rocky Run branch of Craig's Creek.

SINKING CREEK

The head spring of this creek has already been described. After being joined by several other small streams within a short distance, it passes through a fertile valley, about 34 miles, (by the survey, but something more by its meanders.) to New River, and falls, in this distance, nearly 966 feet. Twenty-six miles from its mouth, it was believed, when the survey was made, there was water sufficient for an independent canal; but, from that point downwards, a lockage of 630 feet would have to be provided for. It is in every part too small to use advantageously in the bed of the stream without dams. If dams were to be erected, there is reason to suppose so much of the water would be wasted through the porous matter of which the banks in many places are composed, that enough would not be left to supply the locks, which would be equal in number to those in an independent canal. About 7 or 8 miles from its mouth, the quantity of water begins to diminish, by wasting through the porous limestone rocks, which form the bed of the stream; and several miles from the mouth, it entirely disappears, except when considerably raised by rains or melting snows; it then discharges a part of its waters into New River, by the natural opening. I think the valley through which it passes, is nearly equal in extent and fertility to that of Craig's Creek.

The great elevation of the dividing ridge, the absence of anything like a tolerable supply of water, for several miles, on each side of the summit, and the very unfavorable and expensive kind

of ground for a canal, for 5 or 6 miles, at the lower end of Sinking Creek valley, renders it ineligible, in my opinion, to think of any water communication on this route, except a sluice navigation on Craig's Creek to the mouth of John's Creek, as before-mentioned.

2024–H

Having early foreseen that it was not probable we should be able to accomplish the whole of the extensive surveys and examinations of water-courses, required by our instructions, and also to locate and estimate the expense of the three roads, mentioned therein, during the season; we believed our time would be most economized by giving our attention principally to the water-courses, until the further progress of our work should develope which of these routes would be most likely to be adopted as the connecting link between the navigation of the eastern and western waters; and then to bestow such attention to that route as time would admit, or circumstances might require. We therefore omitted making any survey, for the special purpose of a road between the "highest point of navigable water, on Craig's Creek, and New River, at the mouth of Sinking Creek;" but nevertheless took care to obtain such information on the subject as leaves no doubt on our minds, that a road may be made between those points every where within a limit of 5° of aclivity or declivity, without incurring any unusual expense incident to a mountainous country. This, we believe may be effected, either by taking the valley of John's Creek, for some distance and then crossing John's Creek Mountain, being a continuation of the Allegheny ridge, at a low price, into the valley of Sinking Creek; or by a route near the line of survey. The latter would accommodate the greatest number of inhabitants.

## DUNLAP'S CREEK

Our levelling and survey, commencing at the mouth of this Creek, and terminating at the mouth of Howard's Creek, on Greenbrier River, was conducted along the present travelling road, passing up the valley of this Creek, 5 miles 116 perches, to the mouth of Ogley's Creek. In this distance, the road crosses the stream nine times. The valley is not wide, but affords several good farms. It is traversed from side to side by the creek, very frequently; and, being bounded by mountains on each side, the bank of the creek is very high and steep, where it impinges against those formidable boundaries, making it extremely difficult and expensive to carry either a road or canal on either side of the valley. The stream is too small to admit of a profitable sluice navigation, but is sufficient for the supply of a canal at all seasons.

The fall in the distance mentioned is 126 feet, or nearly 24 feet per mile. If it should be improved for the purpose of navigation, I think the most eligible plan would be to canal and lock on the flat ground between the mountains, and cross the creek wherever it traversed the valley, by means of a dam. But as there will be 126 feet of lockage to provide for on any practicable plan, it will become a subject for consideration, whether the trade that may be calculated on, will justify so large an expenditure on so short a distance.

2924–I

OGLEY'S CREEK

Our survey passed through the ravine of this creek, from its mouth to its source. In dry seasons, it affords in no part a sufficiency of water for the purpose of a navigable canal; and therefore cannot be considered of any importance in relation to commercial transportation.

HOWARD'S CREEK

This creek, about six miles from its mouth, becomes large enough to supply a navigable canal, but too small for a sluice nagivation. The fall, in this distance, is 144 feet, averaging 24 feet per mile. There would be fewer crossings of the stream by a canal down this creek, than of Dunlap's Creek. But probably there would be some difficulty to encounter, on account of the porous limestone land through which it would pass. The fall per mile being nearly the same as Dunlap's Creek, and the trade it would accommodate probably about equal, the same question arises with regard to the propriety of improving it on any plan for the purpose of navigation.

There are on this stream, and its branches, some large tracts of very excellent land.

The distance between the mouth of Dunlap's Creek, on Jackson's River, and the mouth of Howard's Creek, on Greenbrier River, is, by the present road, twenty-eight miles sixty-eight perches.

The elevation of the lowest part of the dividing ridge, above the water of Jackson's River, at Dunlap's Creek, is 1240 feet; and, above the water of Greenbrier River, at the mouth of Howard's Creek, 402 feet.

The grounds between these creeks, and the facilities they present for improvement, &c. will be more particularly noticed in describing the road which has been located on this route.

GREENBRIER RIVER

This river measures, between the mouth of Howard's Creek and its junction with New River, 49 miles 273 perches.
2924-J Its average breadth is about 100 yards, and the fall in that distance 309 feet; averaging nearly 6 feet 3 inches per mile. It partakes largely of a characteristic common to rivers which derive their principal sources from the Alleghany ridges: that is, the very great inequality in the quantity of water discharged at the different seasons of the year. From the best information we could obtain, it appeared, that, for 6 or 7 months of the year, it was usually from 2 to 3 feet deep, on the gravel shoals, where it flows with a rapid current; and that it was subject to very great swells, from the melting of snows, or heavy rains, was visible by the signs left on the banks. In the latter part of summer and autumn, it becomes comparatively very low. We descended it in the latter part of the 6th, and beginning of the 7th Months; the season being remarkably dry, it was said to be lower than it had been before seen, at that time in the year; and that it was seldom lower at any season. Our boat drew about 9 inches water, and we were frequently under the necessity of opening long sluices through the gravel and loose stones, to obtain that depth. When I saw it, three months after, it was still considerably lower. It was then said to be lower than it had been since the settlement of the country. At the time of our passing down, if the water had been properly confined to narrow sluices, in the shallow places, it would have afforded every where, at least 15 inches in depth; and, when I examined it afterwards, about one foot.

Having, as before stated, been necessarily absent, whilst the upper part of the survey of this river was going on, I have only had a very partial view of the first 36 miles; and must, therefore, principally rely on Isaac Briggs' notes, and verbal statements, (obtained about the time of my joining the party,) for particular information relative to the bed of the river. From the knowledge derived from these sources, I think it probable that $400 per mile will make a complete sluice navigation, to the end of the 35th mile. At the great falls in the 36th mile, two locks will be necessary, of 7 feet lift each; and one of the same lift, at the little falls, in the 37th mile.

The 38th, 39th and 40th miles, have considerable descent; the water passing shallow over many ledges, and between loose rocks; the expense of improvement may be estimated at $600 per mile.

The 41st mile much better, and may be improved for $200.

From thence to the mouth of the river, nearly 9 miles, there are many places where little improvement will be necessary; and others, where the clearing of the bed for sluicing, will be expensive: the whole will probably average about $600 per mile.

2924-K The account will then stand thus:

| | |
|---|---|
| For improving 35 miles at $400 per mile | $14,000 |
| " 12 do. $600 | 7,200 |
| " 1 do | 200 |
| 8 locks, of 7 feet lift, 21 feet, at $625 per foot | 13,125 |
| | $34,525 |

I feel quite satisfied that this estimate will be fully adequate to the purpose for which it is made; that is, to making the most perfect kind of sluice navigation the whole distance, including the three locks in the 36th and 37th miles.

The bottom lands on this river are not very extensive; but there are generally more or less on one side or the other, and frequently on both.

The value and importance of this navigation will be best considered in conjunction with the upper section of

2924-L NEW RIVER

The examination, levelling, and survey of which, from the mouth of Greenbrier, up to the mouth of Sinking Creek, was commenced on the 5th of the 7th Mo. 1819.

This is truly a noble river. Notwithstanding it was represented to us as being remarkably low, yet it afforded a superabundance of water for every purpose of internal navigation. The fall in this part of the river, considering the mountainous country it passes through, is comparatively moderate. The principal falls are, the Bull-falls, McDaniel's, Anderson's, Wiley's, Neilley's and Peter's mountain falls: none of which has ever been improved in the least degree; yet we ascended them all with our boat; though, in two or three instances, with considerable difficulty, after taking out our baggage, stores, &c. The breadth of the river from 2 to 300 yards, and the length of this section 55 miles 58 perches.

The fall and description of each mile, and the estimates of expense for effectuating a good sluice navigation of 2 feet, at all times, are as follows:

1st mile—Hard to ascend in places, but may be easily improved by 2 or 3 sluices, estimated at $400
Fall 7. 11 f.
2d mile—Requires no improvement worth noting. Fall 1. 61 f.
3d mile—Same as the last. Fall 2. 25 f.

4th mile—Wide and shallow, will require some improvement, estimated at ..... $300
Fall 5. 07 f.

2925 5th mile—Nearly the same ..... 300
Fall 6. 70 f.

6th mile—Excellent navigation. Fall 0. 22 f.

7th mile—Requires a little improvement estimated at ..... 150
Fall 3. 11 f.

8th mile—Good navigation. Fall 1. 07 f.

9th mile—A small improvement necessary, estimated at ..... 150
Fall 4. 04 f.

10th mile—The Bull falls are situated in this mile, in which there are about 3 feet fall in 60 yards, a good sluice and tracking path may be made on the eastern side for about ..... 300
Fall 5. 83 f.

11th mile—This mile will be more expensive to improve than any of the preceding, the bed is generally composed of smooth rock and very wide; it will require some long sluices but not of the most expensive kind; they may be estimated at ..... 800
Fall 8. 62 f.

12th mile—No improvement necessary worth noting. Fall 2. 31 f.

13th mile—Very good. Fall 0. 93 f.

14th mile—The same. Fall 1. 40 f.

15th mile—A long sluice will be necessary to overcome the difficulty in passing several contiguous ledges, the expense may be about ..... 500
Fall 6. 84 f.

16th mile—Very good. Fall 0. 42 f.

17th mile—In this mile occurs McDaniel's falls of nearly 4 feet in about 100 yards, a good sluice may be easily made on the west side and will probably cost about ..... 500
Fall 4. 90 f.

18th mile—Very little improvement necessary. Fall 2. 41 f.

2926 19th mile—Anderson's falls are in this mile, rather more than 2 feet in 80 yards, also another of nearly the same, each of which will require a sluice, and may cost together ..... 600
Fall 4. 78 f.

20th mile—A small fall succeeded by a long rapid shoal, which will require a long sluice, but not very expensive; it may cost about ..... 500
Fall 7. 67 f.

21st mile—A part of the rapid continued, and a few other ripples, will require small improvements: (say) in the whole ..... 200
Fall 4. 73 f.

22d mile—This mile requires a little improvement in places and may cost ..... 100
Fall 3. 68 f.

23d mile—Requires no improvement worth noting. Fall 2. 40 f.

24th mile—Several ripples and shoals in this mile will require a little improvement by sluices very easy made, the cost of which may be about ..... 200
Fall 5. 05 f.

25th mile—In this mile are Wiley's falls, composed of a ledge of rocks extending all across the river, the fall is nearly 4 feet and very abrupt. The sluice round the end which must be on the west side of the river, will be expensive; it will probably cost ..... 500
Fall 4. 51 f.

26th mile—No improvement necessary in this mile worth noting. Fall 3. 79 f.

27th mile—The same. Fall 2. 15 f.

28th mile—Several ledges and some shoals which will require some sluicing, estimated at ..... 300

2927 29th mile—¾ of this mile very good, but in the last ¼ occurs Neilley's falls, the greatest we have yet seen in the river. The whole fall is about 11 feet; six of which is nearly perpendicular, except a very thin sheet near one shore, which is more gradual, and over which (after unloading) with some difficulty, we ascended with our boat. A good sluice and tracking patch can be conveniently made along shore, and may cost about---------- $700
Fall in the mile 11.21 f.

30th mile—Excellent water. Fall 0.93 f.

31st mile—Commences with a very long rapid shoal, after which good water to the end. An easy sluice may be made on the west side and will probably cost---------- 400

32d mile—Good navigation. Fall 1.37 f.

33d mile—The same. Fall 1.06 f.

34th mile—A long shoal, but so regular that very little improvement is necessary. Fall 8.06 f.

35th mile—Generally good water, the few ripples that occur require but little if any improvement. Fall 3.93 f.

36th mile—Good water. Fall 2.96 f.

37th mile—Early in this mile occurs Peter's mountain falls. In the present state excessively hard to ascend, but by unloading our boat and very hard labour we succeeded in getting up. The abrupt fall at the lower end is about 5 feet; this is succeeded by several ledges above; making in the whole 9.56 f. This fall will cost more to improve than any we have past. The sluice must be on the west side and ought to be about ¼ long. To complete it in the best style, it will probably cost---------- 1,000

38th mile—Good navigation. Fall 1.41 f.

39th mile—More rapid than the last, but requires very little improvement. Fall 3.17 f.

2928 40th mile—In this mile, occurs a long rapid shoal, which ought to be improved by a regular graduated sluice, and may be estimated at---------- 400
Fall 8.45 f.

41st mile—No improvement necessary, worthy of note. Fall 3.36 f.

42d mile—The same. Fall 3.06 f.

43d mile—There is in this mile a fall composed of four limestone ledges, over which the water flows very rapidly, but not with an abrupt fall. It descends 5 feet in about 400 yards. An improvement by a graduated sluice, will be necessary, and may cost about---------- 400
Fall 6.66 f.

44th mile—A long shoal in this mile, which will require some sluicing, estimated at---------- 300

45th mile—In this mile there is a long rapid shoal, which ought to be improved by sluicing, and will probably cost---------- 400
Fall 9.13 f.

46th mile—Begins with a continuance of the last-mentioned rapid for a short distance, then good water to near the end, where there is a fall of about two feet: the improvements for this mile may be stated at---------- 200
Fall 5.38 f.

47th mile—No improvement necessary. Fall 3.53 f.

48th mile—The same. Fall 3.09 f.

49th mile—The most of this mile is swift water, but does not require sluicing. Fall 6.84 f.

50th mile—A continuation of swift water, and, in places more rapid than the last mile: some sluicing will be necessary and may be estimated at---------- 300
Fall 11.23 f.

2929 51st mile—Begins with a continuation of the shoal for a short distance; then good to near the end, where it is excessively rapid. An easy sluice may be made round a small island, and might cost about ..... $200
Fall 4.43 f.
52d mile—Begins with a part of the rapid water just mentioned, and to which the last mentioned sum is applicable; the remainder of the mile smooth water. Fall 3.43 f.
53d mile—Good navigation. Fall 1.32 f.
54th mile—A long rapid in this mile, which ought to be sluiced in places, and may probably cost ..... 300
Fall 9.64 f.
55th mile—Smooth deep water. Fall 0.70 f.
56th mile—At 58 perches in this mile, arrived at the mouth of Sinking Creek, where we terminated our survey. No improvement necessary. Fall 2.40 f.

Total expense ..... $10,400

The whole fall in this section, f. 251.47, averaging f. 4.52 per mile.

The valley through which this part of the river passes, is very unequal in width. There is more or less of bottom land in almost every part; but, in several places, it widens out to a great exent, and affords several large tracts of first rate land. The second bottoms, and many of the hill sides, are also very rich.

Whilst engaged on this survey, great pains was taken to collect information relative to the character of the river, and the adjacent country, between the mouth of Sinking Creek and the Carolina line. This infirmation has been corroborated by all we have since received on the subject; and goes to establish the fact, in my mind, that the section alluded to, above the termination of our survey, (which measures about 130 miles by water,) is more
2930 susceptible of improvement than the section between Sinking Creek and Greenbrier; the falls being fewer in number, in proportion to the distance, and none of them so difficult to improve, as some we have described:

The counties of Montgomery and Wythe, through which this river and its branches extend, are known to be remarkably fertile; abounding also in iron ore, and manufactories of that article. Grayson also affords some good land, plenty of iron ore and one iron manufactory. Adjoining the two latter, to the west, is the rich county of Washington, on the waters of the Holstein, abounding with vegetable and mineral products. Gypsum or Plaister of Paris, of the best quality, is found here in great abundance, and salt cheaply manufactured to any requisite amount.

The quantum of utility resulting from the navigation of this river, will much depend on the degree of perfection to which the navigation in the James River valley, may be brought. If the best description should be effectuated, so as to reduce the price

of transportation from Covington, at the mouth of Dunlap's Creek, to Richmond, to a comparatively small sum, in proportion to the value of the article transported; large quantities of bulky articles, such as tobacco, flour, hemp, cordage, pork and beef in barrels, bacon, and perhaps bar iron, and iron castings, would find their way down the New River, up Greenbrier, and across the portage to Covington, and thence to Richmond market; or, perhaps, at some seasons, down to Sinking Creek; then across the portage to Craig's Creek, and thence down to the main line on James River.

If a good sluice navigation only should be made on James river, we still might calculate on some of the most valuable of these articles with the addition of butter, ginseng and saltpetre, taking one of these directions to market; and in either event, goods of every description would pass from Richmond into these counties by this route. In addition to this, great benefits would result to the inhabitants of the neighbouring counties by the facilities such a navigation would afford to the mutual interchange of products and commodities, the growth and manufacture of their own country.

2931 The consideration of this branch of the subject will again be necessarily taken up in the general remarks towards the conclusion of this report.

On the 13th of the 7th month, we left Sinking creek, arrived at the mouth of Greenbrier river and commenced our examination, levelling and survey down the New river from that point on the 16th. The description, fall and estimate of expenses are as follows:

| | |
|---|---|
| 1st mile—Requires sluicing in several places and will probably cost. Fall 6.42 f. | $300 |
| 2d mile—Very wide and shallow, but will admit of a very handsome sluice on the left, estimated at. Fall 8.25 f. | 400 |
| 3d mile—Nearly the same as the last, expense of sluicing estimated at | 400 |
| 4th mile—About ¼ of this mile nearly the same as the two last, then for about 120 perches the descent becomes much more rapid, and in the present state of the water is dangerous to descend, and in all states must be excessively hard to ascend; the bottom is composed chiefly of flat rock. The remainder of the mile smooth water. A safe graduated sluice may be easily made through the rapid part of this mile, and will probably cost. Fall 14.35 f. | 600 |
| 5th mile—Good navigation. Fall 2.07 f. | |
| 6th mile—In this mile are Brooke's falls, where the water falls 9 feet 8 inches in about 120 perches: the lower end very abrupt over broken rocks, which renders it very difficult and dangerous to pass in the present state of the water: a sluice and tracking path may be made on either side at an expense of about. It would however be a rapid one, and of course laborious to ascend; a lock would be a more eligible improvement at this place; for the construction of which the shores afford tolerable facilities. Fall in the mile 9.88 f. | 1,000 |

2932 7th mile—Begins with very deep smooth water, but a rapid with a fall at the lower end over a ledge soon occurs, succeeded by two or three small falls; then good water to the end. A tolerably easy sluice may be made for about ..... $500
Fall 6.66 f.

8th mile—No improvement necessary worth noting. Fall 2.89 f.

9th mile—Nearly the same. Fall 3.11 f.

10th mile—This mile includes the great falls of New river, the whole fall in the mile is f. 32.27, about 2 feet of which occurs in a shoal above the principal fall which is over a ledge about 22 to 24 feet high, in the middle of the river; the balance consists of broken rapids for a short distance below. Notwithstanding the ground on the left side is very favorable for the purpose, yet the very great fall in so short a distance renders the sluicing plan entirely ineligible, 30 feet of the fall being in about ¼ of a mile. It is therefore my opinion that this great fall ought to be overcome by locks. The site is excellent for the purpose; 3 of 9 feet lift each may be made to answer the purpose by allowing some fall in a sluice above the first, and also some below the third; the whole expense of this mill will probably be ..... 25,000

11th mile—Good water. Fall 1.17 f.

12th mile—In this mile there is a very swift rapid, but may be very easily improved by a sluice on the right side at a very small expense, (say) ..... 200
Above and below this rapid the water is good. Fall 10.90 f.

13th mile—Very little improvement necessary. Fall 4.03 f.

14th mile—A brisk current in a part of this mile, a little of which may require some improvement, estimated at ..... 100
Fall 5.31 f.

2933 15th mile—This mile ought to be improved by short sluices in two or three places, which will probably cost ..... 150
Fall 6.33 f.

16th mile—In this mile, there is a long rocky fall, which will require considerable improvement. I think the expense may be estimated at ..... 600
Fall 14.46 f.

17th mile—Begins with a small fall; several others also occur, which ought to be improved by short sluices. The expense of the whole may be estimated at ..... 400
Fall 7.61 f.

The river appears to be changing its character. Above the great falls, the surface is remarkably free from rocks, except at a few falls. The bed is now more contracted, and a great number of rocks rise above the surface of the water.

18th mile—Several small falls, which will require short sluices, and may cost ..... 200
Fall 4.41 f.

19th mile—Nearly the same as the last, except one fall, which is greater, and more abrupt. Expense of sluicing ..... 350
Fall 7.47 f.

20th mile—Good navigation. Fall 0.65 f.

21st mile—Nearly the whole of this mile is good navigation; but, near the end, the water becomes very much contracted, and an excessively rapid current commences, called the winding falls. The mile terminates about 20 perches below the beginning of the fall, in which distance there is a descent of nearly four feet. The whole fall in the mile, 6.64 f.

22d mile—Begins in the last mentioned fall, which continues about 40 perches further; in which distance there is a fall of f. 6.52; making in the whole f. 10.48, in this rapid. In one place, the water, in its present low state, is confined to about 30

2934 yards; the current through the whole is excessively rapid; but a sluice and tracking way may be very conveniently made on the left short, which will make the passage of boats tolerably easy. Expense estimated at ..... $500
Fall in the mile, 11.30 f.

23d mile—Several rapid shoals in this mile, will require improvement, and may cost ..... 400
Fall 9.11 f.

24th mile—Nearly the same as the last, except that the expense of improvement may be greater (say) ..... 500
Fall 9.82 f.

25th mile—A very rapid and dangerous shoal, called Gid's defeat, occurs in this mile. A tracking path and long graduated sluice, on the left, is the most eligible mode of improvement, and may cost ..... 600

The remainder of the mile tolerably good. Fall f. 15.31, about f. 13 of which is in the rapid above mentioned: the distance about 40 perches.

26th mile—Requires some improvement; estimated at ..... 250
Fall 6.44 f.

27th mile—Good navigation. Fall 0.20 f.

28th mile—In this mile, occur three distinct falls; one of them dangerous to descend. They will all require sluicing, and will probably cost ..... 700
Fall 16.09 f.

29th mile—No improvement necessary, worth noting. Fall 5.80 f.

30th mile—In this mile are several rapids, which will require improvement; estimated at ..... 600
Fall 13.43 f.

31st mile—Early in this mile, occurs a long rapid, terminated
2935 by a fall over rocks at the lower end. It may be improved by a sluice taken through a small point of rocks, on the right shore. The water is then very deep and smooth, to near the lower end, where there is another considerable rapid. The expense of improving the two, may amount to ..... 700
Fall 15.12 f.

32d mile—Begins with a short, but excessively swift broken rapid. The fall is about 5.50 f. in little more than 100 yards. It must be improved by a sluice and tracking path, which may probably cost ..... 400
Fall f. 8.

33d mile—Several rapids and two small falls, over ledges, in this mile, all of which may be made tolerably easy by sluicing. The expense will probably be ..... 500
Fall 10.46 f.

34th mile—All good water, except one gravel shoal. The expense of improvement estimated at ..... 100
Fall 4.83 f.

35th mile—Good navigation. Fall 1.20 f.

36th mile—In this mile occurs the Buffalo Falls, consisting of a long gravel shoal, with some broken water by rocks at the lower end. The navigation may be made tolerable by a sluice, that will probably cost ..... 450
Fall 14.60 f.

37th mile—Begins with a short rapid, which will require a little improvement; also a small fall just below; the two may amount to ..... 150
Fall 6.12 f.

38th mile—In this mile there are several sheets of smooth water, but there are two rapids and a rocky fall to improve; these may be estimated at ..... 500
Fall 13.05 f.

2936 39th mile—Several small rapids in this mile but none that require improvement; a very small fall near the ned may cost about ..... $50
Fall 6.95 f.

40th mile—Most of this mile is good water; but a pretty long rapid occurs near the lower end which will require a sluice, and may cost ..... 200
Fall 5.85 f.

41st mile—In this mile are several rapids which require improvement; the expense may be estimated at ..... 450
Fall 10.25 f.

42d mile—Some rapids with falls over rocks at their lower ends occur in this mile; they may all be made tolerably good by sluices, which will probably cost ..... 500
Fall 10.03 f.

43d mile—Begins with very deep smooth water; at about 1/4 commences a rapid, shallow and difficult to pass (at this state of the water) near the lower end: it can be easily improved by a sluice on the right side, estimated at ..... 250
Then good water to the end. Fall 7.81 f.

44th mile—Mostly tolerable water, except a fall near the lower end that may be conveniently sluiced for about ..... 150
Fall 7.83 f.

45th mile—Commences with a rapid that is succeeded by several others; to overcome which sluices will be necessary; particularly for one near the lower end that is terminated by a rocky fall, where the river is contracted to about 30 yards in width, and will be expensive to improve on the right, where the sluice would be most likely to keep open; the immense rocks and apparent violence of the freshets forbid the attempt on the left; there will be some liability to its filling with gravel, otherwise the site
2937 on the right would be good. I do not think however that this effect would often take place, and then but partially: It would be nearly straight and very long, and of course expensive; though there would be no blasting of rocks. On the whole this mile will cost more to improve than any we have past, except where a lock or locks are recommended. To render the navigation tolerably good, the expense of the mile ought probably to be estimated at ..... 1,200
Fall 19.75 f.

46th mile—Mostly good water, except one fall consisting of three ledges, which will require a sluice and tracking path, that will probably cost ..... 500
Fall 8.90 f.

47th mile—At 130 poles in this mile is Bowyer's ferry, above which there is only 6 inches fall and consequently requires no improvement .....

Total cost of improving the section from the mouth of Greenbrier to Bowyer's ferry ..... $39,850

Total fall in this section 402.76 f.

The remainder of the 47th mile continues good to the end, except one fall, the improvement of which may cost ..... 200
Fall 5.08 f.

48th mile—Several rocky falls in the upper part of this mile. The very confined limits of the bed, and the immense masses of rock on the shore in places forbid the idea of sluicing. Two modes of improving present; the one is by a canal nearly ½ mile long on the left shore with two locks at the lower end, the other is by removing a few of the worst projecting rocks near the shore and filling some of the chasms between the rocks on the shore so as to form a tolerable footway or tracking path for hauling by a rope, fastening in the rocks at particular places ring bolts,

2938 or iron pins for security. Under all circumstances perhaps the latter ought to be adopted. This will probably cost ..... $500
A canal may be built and locks secured from injury by freshets, but the canal would be very expensive, as it would require one great wall the whole distance, and in some places two.
Fall in the mile 16.95 f.

49th mile—A considerable part of this mile is good water; then a fall round which a sluice may be conveniently made on the left shore; after this another rocky fall occurs that cannot be easily sluiced; the tracking plan must therefore be adopted. The expense for this mile is estimated at ..... 700
Fall 17.11 f.

50th mile—In this mile are several tremendous falls, or rather different parts of the same fall; immense rocks have fallen in on both sides, so as to contract the water to a very narrow space, in one place estimated to be not more than 40 feet, and at this low state of the water a rock appears about the middle even of this narrow channel; but the water being of course very deep between the rocks at this place it is not so dangerous to pass as at several others where it is wider, and the water completely broken into white foam, from shore to shore by the dashing and friction occasioned by the rocks below; something may be done to render the passage downward safe at these places, and also those before mentioned; but towing only can be relied on as the means of ascending. The expense of improving this excessively rugged mile may be estimated at ..... 1,200
Fall 26.16 f.

51st mile—Of the same character as the last, but the falls in one or two instances more rocky and dangerous to descend than any we have passed. In descending one of these of 13 feet, the boat was driven with great violence on a ledge and stuck fast
2939 in a very perilous situation, the water being very deep and excessively rapid on both sides, we could find no means of relieving her but by getting a part of the baggage on shore by means of ropes, which had to be again transported a considerable distance over, between and under huge rocks, forming as rough a mass as the mind can well conceive such materials can possibly exhibit. The fall in this mile is also great, and must be improved in the same way as several of the last; (that is,) by putting one of the shores in such a state that a towing rope may be every where carried by men, and by removing some prominent rocks, and in places making short sluices where circumstances will permit, for the passage of the boats. The expense is estimated at ..... 1,600

52d mile—Near the beginning of this mile a great and dangerous fall occurs, and a considerable one near the lower end; the remainder tolerable water; expense of improvement may be estimated at ..... 1,000
Fall 19.75 f.

53d mile—Nearly ¼ good water, then a great and rough fall of 15 feet in about 200 yards; the water then tolerable to the end; expense of improving not so great in proportion to the fall as some of the former miles, in consequence of the shores in places being less rugged (say) ..... 600
Fall 17.16 f.

54th mile—Early in this mile is a rocky fall of 10 feet; the whole of which except a few inches is in the distance of about 100 yards; then some good water; after which another fall; then good to the end; expense of improvement ..... 1,000
Fall 18.66 f.

55th mile—Begins with good water, then three abrupt falls
2940 in close succession, or rather different parts of the same fall; then good water to near the end, where there is a very rough and abrupt fall; expense of improvement estimated at $1,200
Fall 20.33 f.

56th mile—A fine sheet of water for about ¾; then a long fall to the end; but not so abrupt nor dangerous as many others; expense of improvement 800
(these falls are called Claypole's shoals)
Fall 15.39 f.

57th mile—Begins with a part of the fall last mentioned, after which are two or three other small falls that may require some improvement; expense for the mile may be stated at 600
Fall 11.69 f.

58th mile—Begins with good water; and continues to near the end, where there is a fall of 9½ feet in about 150 yards; this may be improved in part by sluicing, and in part by a tracking way; the expense is estimated at 400
Fall in the mile 10.78 f.

59th mile—Good water except one fall over ledges of rock; which may be improved by removing some rock, a little sluicing and making a tracking path; which will probably cost 500
Fall in the mile, 9.28 f.

60th mile—In this mile are several falls over ledges, which will require the same kind of improvements as those mentioned for the last mile, they may be estimated at 600
Fall 13.42 f.

61st and 62d miles—Begin with a considerable fall over a ledge, then after a short distance of smooth water another occurs of about the same perpendicular fall, (viz. 6½ feet,) but rather more gradual; then another small sheet of good water, after which com-
mences a very long and great fall of a character rather
2941 different from any that we have past. Some of those were principally composed of ledges of rocks across the bed of the river forming abrupt and sometimes perpendicular falls of different heights. Others were formed of large pebble, making the descent more regular but often producing excessively rapid water; (the latter description has generally been denominated rapids in the preceding notes;) both of these were however frequently interspersed with rocks rising above the surface of the water. But the fall that commences in this mile, appears to be mostly formed by a loose jumble of detached rocks of various sizes, that have either been precipitated from the steep sides of the adjoining mountains, or lying in their original situations have had the earth removed from about them by the water, and the cavities thus formed filled in part with stones and rocks of a smaller size and rounded like pebbles, (though many of them are three to four feet diameter,) which have been brought down by the current. The original rocks are so numerous and large that at a small distance they appear to occupy the whole bed of the river, and entirely conceal the water from view. The passes between are of course extremely crooked, and the water flowing with very great velocity; they cannot be passed by a boat of the size of ours, (which was 56 feet long and 7 wide) with any loading without almost a certainty of being dashed to pieces. We were therefore under the necessity of taking out our baggage and stores in order to lighten the boat as much as possible; these we had to carry over excessively rough rocks to the lower end of the falls (as we then supposed), but after a few perches of moderate water, on sudenly turning a point, we were again surrounded by rocks as large as Hay stacks, and some as large as moderate sized dwelling-houses. With great difficulty and danger however we

worked our way through them. These rocks present the
2942 most formidable bar to improvement of any thing we have yet seen. To form a passage through them near the shore so as to render the descent quite safe and also to give a perfect command of ascending boats, by means of a tracking way, &c., I should suppose would require for these two miles---------- $5,000

Fall in the 2 miles 60.68 f.

63d mile—A continuation of the same kind of rude bed and savage shores, with encreased difficulty of descending; at one place we were not only obliged to take out our baggage and stores, but also to take down our cabin, and transport the whole over the rocks; after the boat was thus lightened, by the exercise of skill and dexterity in the boatmen that were truly astonishing, they succeeded in passing a very crooked course through these great rocks over excessively rapid water; but not without imminent danger. This fall is succeeded by about 100 poles of smooth deep water quite clear of rocks, but then occurs a fall of still greater difficulty to pass than any preceding it. We had again to unload and take down our cabin, and then get deep into the water behind a rock and hold the boat by a rope attached to the stern, to prevent her from being dashed to pieces against rocks at a short distance below, and exactly in front of a narrow opening through which she had to pass, over an abrupt fall of three feet. After passing two or three such falls the load and cabin were again taken on board; and carried a very short distance, then again put out on the rocks, and the boat passed down another dangerous fall in the same way; just below which the mile ends. The expense of improving this mile may be estimated at-------- 2.000

Fall 17.48 f.

64th mile—Begins with good water, than a fall of 7, feet, after which good navigation to the end; the expense of
2943 improving---------- 400

Fall 8.24 f.

65th mile—Begins with a fall of about three feet; just below which the river suddenly expands from less than 100 yards in width to about ¼ of a mile, and smooth and deep to the end of the mile. The small fall at the beginning will require a little improvement. which may probably be done for---------- 250

Fall 3.34 f.

66th mile—A continuation of wide deep water; at ¼ passed the mouth of Gauley river, below which the river is known by the name of Kanawha, and continues wide, but becomes shallow with some fall, no improvement necessary in this mile. Fall 2.78 f.

67th mile—The river still continues wide and most of the width shallow; but the navigation tolerable. Fall 4.45 f.

68th mile—At fifty perches in this mile are the great falls of Kanawha; which we find to be 20.37 f. where we unloaded our boat, took down the cabin, hauled her over the rocks and launched her into the deep water below Stockton's saw mill. This is one of the most convenient situations for the application of water power I have ever yet seen.

Total expense from Bowyer's ferry to the falls of Kanawha. $18,850

Total fall from the mouth of Greenbrier to the foot of the falls of Kanawha 743.77 f.

As we descend the valley of the New River from the mouth of Greenbrier it becomes gradually more contracted, and its mountain boundaries higher and more rugged; several small tracts of bottom land are found in the first 10 or 12 miles, but from thence to Bowyer's ferry, 10 acres of good land in a body rarely

occurs. About 5 or 6 small cabins are the only human habitations that are to be seen in 35 miles. From the mouth of Man's creek ¼ below Bowyer's ferry to the mouth of Gauley river 18 miles, not a trace of human industry or art is any where
2944 to be seen, except a part of a small field which approaches the river at the mouth of Mill creek. Indeed for a large portion of that distance a spot of earth of sufficient dimensions for the ground plan of a moderate sized dwelling house is rarely to be seen.

The Sewell mountain rising in the midst of a broken mountainous country, presents an exterior different from those around it. The rise from its base is very long and of course less precipitous than most others; and instead of a narrow ridge on its summit, the form that the surrounding mountains generally assume, it spreads out, and exhibits to the view a considerable extent of very high undulating land, the spurs projecting from it in various directions bearing different names. For more than 40 miles, the New river has worked its way through this great tract of elevated land: above Bowyer's ferry the appearance from the river is that of high mountains on each side, indented by the water courses which rise in the high grounds beyond the view, and descend by rapid cascades to the river. In places perpendicular cliffs of great height are seen, but the general appearance is a steep slope covered with trees; contracting the water to an average of about 120 yards. Below Bowyer's ferry the scene is considerably changed; tremendous cliffs from 5 to 7 or 800 feet in height generally form the boundaries of this frightful ravine: these are so continuous that in one part for four miles in extent, the river is entirely unapproachable by man from either side. Confined within these rugged limits to a very narrow space, the water sometimes rises to the extraordinary height of 50 feet, notwithstanding the very great fall in its bed.

In making the surveys of the Greenbrier and New rivers, the alternatives mentioned in our instructions were not forgotten, but as it was demonstrably clear, that surveys of, and estimates for all the different descriptions of navigation mentioned could not be made by us in one season, and comply with our other important duties; we selected according to our own judgment, that mode which we believed the rivers themselves, and other circumstances connected with the navigation pointed out as most eligible,
2945 leaving the others to be taken up at a future time, if it should be deemed necessary. But notwithstanding we have thus limited the field of our labours, yet we hope such information will be derived from our reports as to enable the board to determine whether further surveys and estimates may be useful.

It may be observed, that so far as the sluicing plan has been recommended, the estimates are made with a view to the sluice in every instance being made contiguous to one or other of the shores; so that the boatmen may always avail themselves of the advantage of a towing line when the rapidity of the current requires it.

And to what has been already said relative to the tracking plan, recommended for the more rugged parts of the river, where sluices cannot be made, nor setting poles used with advantage, it may be added, that by the use of a block and pulley attached to the boat to be used at particular places, the power of a few men will be adequate to the towing or warping of a loaded boat up any current that will probably occur. But it must be remembered, that this description of navigation is only calculated for comparatively low water, that is, from the state in which we saw the river to about 10 feet higher, which may be about the usual spring heighth. In freshets any navigation in the bed of the stream must be dangerous in consequence of the violence of the current and the roughness of the water. The construction of an independent canal along this ravine from Bowyer's ferry to the falls appears to be quite inexpedient, if not utterly impossible. But I think it is possible on the left or west side to level the fallen rocks at the foot of the cliffs, just above high water mark, so as to admit of a railway the whole distance. It would, however, be very expensive and will probably be left for posterity to execute.

NEW RIVER

On the 28th of the 8th month, I left Abingdon, for the purpose of viewing that part of the New River, mentioned in my instructions, and arrived at Captain Newell's ferry, opposite to the
2946 Lead Mines, on the evening of the 29th. The next morning, in company with Hugh P. Taylor, commenced the examination.

The navigation is good for about 3 miles below the Lead Mines: there occurs a small shoal that will require a little improvement; immediately below this, there is another, where the water falls about 5 feet in 200 yards, and will require a sluice on the left shore, and a low wing dam, to turn in the water. I am of opinion that $1,000 will be sufficient to effect the improvement of these two shoals.

About 5 miles below the Mines, are Foster's Falls. It appears the fall may be about 18 feet in half a mile, divided into 9 or 10 parts, by small ledges of rocks, none of which occasions a perpendicular fall, and but very little appearance of rock above water, so that the passage is perfectly safe to descend, in almost any part, except when the river is low.

But there will be some difficulty in procuring an easy ascending navigation. The left side presents the greatest facility for a graduated sluice, over some of the upper ledges, but near the lower end of the fall on that side, it would be rapid, and the rocks very smooth for polling. It would, however, be close in shore, and some advantage might be taken of towing lines, ring bolts in the rocks, &c. On the right shore, there appears to be excellent ground for a canal and locks, if that plan should be thought most advisable. But as we had no boat to cross over, so as to examine both sides critically, I cannot say with certainty which side ought to be adopted. If a sluice on the left side will answer the purpose, I think it may be made for $1,200.

Between these falls and the mouth of Reedy creek, there are four small falls, the last of which is called Deer falls, and is the worst of the four. They all consist of smooth ledges, making swift water, but not dangerous, nor very difficult of ascent; they may, however, be a little improved for a very moderate sum, say $150 each.

Just below Reed creek, is Reed island, at the lower end of which is a small fall of about one foot, over a ledge of rock,
2947 through this there is a sluice close to the right shore: then smooth water for about two miles, where there are small ripples opposite to Pine run, which require very little improvement. In the next 4 or 5 miles, there are three or four ripples that may require slight improvements. A small island then occurs, near to the left shore; opposite to which, there is more fall than for several miles above, in the same distance. It is, however, so regular, that it presents but little difficulty to ascending, and none to descending boats, except that a natural sluice may require a little opening.

From Reed creek to the lower end of this island, I think $600 will do all that is necessary to be done.

From this island, for several miles down, to Ross's falls, there is but little fall, but the river is generally wide, and in places, rather shallow; a few of the ledges will require opening; the expense of which may be estimated at $500. Ross's falls are situated nearly opposite to Captain Ross's house; the fall is about 2½ feet in 50 yards, and will require a graduated sluice on the right side, which will probably cost $700. Then for about two miles tolerably good, but a few ledges may require some improvement, for which may be allowed $300. Then occurs a long fall, probably nearly equal in the whole, to Foster's before described. It was impossible, without a boat, to decide with certainty, how it ought to be improved; but the most probable plan appeared to be, by a graduated sluice near the right shore, or rather, several short ones, the expense of which may be estimated

at $1,200. This fall is just above the dividing line between Wythe and Montgomery counties.

Below this fall there is nearly a mile of good water; after which, commences a long fall, composed of a number of ledges in succession, none of them large, but several will require improvement by opening passages, constructing wings, &c. I think $1,000 ought to be allowed for this purpose. Then to Peak creek, there is but little fall, but the river is wide, and in places shallow; to improve these $300 will probably be required. About the mouth of Peak creek there are several islands and some fall; the sum of $500 may be estimated for procuring a 2948 good navigation through them. Then good water to the late Col. Trigg's farm; opposite to which, there is a fall of two to three feet in 200 yards. Through this fall it will probably require $400 to procure a passage. There is also another small fall, about the lower end of this farm, which will require but little improvement. Then good water to within half a mile of English's ferry, where there is a fall of about 3 feet in 00 yards, and a quarter of a mile of swift water below. The upper part requires improving, which may cost $400.

From English's ferry to near Pepper's ferry, there is no obstruction to navigation worth noting.

A short distance above the latter, there is a fall of nearly 8 feet in a quarter of a mile, but the descent is so regular, that loaded batteaux might then have descended near the right shore with perfect safety, and ascended with light loads: and with water a little higher, boats might ascend in every part, for there are no projecting rocks. But to make it quite easy to ascend, there must be a graduated sluice on the left shore, for nearly half a mile; this would also be the downward passage in very low water: and would cost, I think, at least $1,000. The navigation is then good to Shell's falls, 2 miles below the ferry. These present a more serious obstruction than any above. The fall is estimated at 7 feet in less than 200 yards, and at the lower end very abrupt and broken; there is, however, on the right side, which is much the longest end of the falls, a gravel bed that rises above all the ledges; over this the water flows with a tolerably regular shallow current. A sluice might be made on this side that would be quite easy; but it would be liable to fill with gravel, unless it was well guarded on the river side. To effectuate such a sluice would probably require an expense of $1,500. Either this plan must be adopted, or a lock must be constructed on the left side, which would cost a much larger sum.

From this place round the Horse-shoe and quite down to Michael Brown's, there are only a few inconsiderable ripples:
but a short distance below his farm, the river becomes wide
2949 and shallow, with a moderate fall; it will probably require
improvement in places down to the gap mountain falls, a distance of 3 miles, for which may be estimated $300 per mile.

The falls just mentioned occur at the passage of the river through the Gap mountain, and at the line between Montgomery and Giles counties. The fall is about 6 feet in 200 yards. It appears from the best view that could be taken of it without a boat, which was from the left shore, that the plan for improvement will be by a graduated sluice on the right side; this may be made much longer than the fall, and I believe will very well admit of a tracking way on the shore, which will make it very easy. The expense may be estimated at $1100. Ledges commence a little below the principal fall, and continue in succession for a mile or upwards: no one of these presents any great obstruction to navigation, but taken collectively, they form a very considerable fall, and in order to get a good passage through them, in an easy direction, it will probably require the expenditure of $600. Thence to Sinking creek, the navigation is generally good; there are, however, a few ledges that may require some expense; I believe $600 will be amply sufficient for the whole.

In this examination, I was considerably aided by the map and field notes of a survey of the river, lately taken by James Caruthers and Hugh P. Taylor: The latter of whom accompanied me with these documents the whole distance from the lead mines to Sinking creek. By that survey this distance is 68 miles 52 rods.

* * * * *

2949½ Before I close this report, it is but justice to add, that our assistants, engaged in the arduous labors of the late season, acquitted themselves, in the several duties assigned them, with faithfulness and propriety. Thomas Mifflin Ladd, of this city, has become expert in the use of the levelling instrument, and with further practice, and the experience of a few more years, may become useful to the community. The same may be said of Hugh P. Taylor, who, although a young man, is in possession of much topographical knowledge of the interior of this State. Moncure Robinson of this city, is eminently entitled to our respect. Without any compensation, whatever, except the payment of his expenses, he accompanied us nearly the whole season, and always performed the duty of a hand, without shrinking from the most laborious tasks. He possesses much information for his age, and a mind calculated to render him useful to his fellow-citizens.

I also feel it a duty to say, that our two principal boatmen, captain Robert Creasey and Isham Scruggs, are entitled to great credit, for their good conduct whilst in our employ; and particularly for the deliberate judgment, courage, skill and dexterity, exhibited in conducting our boat through the long and tremendous rapids of New river; which, considering the size of our boat, I must believe, was a voyage fraught with as much difficulty and danger, as ever was completed with perfect safety.

With great respect, this Report is submitted, by

THOMAS MOORE.

2950 *Government exhibit 33*

REPORT OF THE U. S. ENGINEER DEPARTMENT SECRETARY OF WAR, YEAR 1877

(pp. 62; 331–332)

7. Improvement of New River, from the lead-mines in Wythe County, Virginia, to the mouth of the Greenbrier River, West Virginia.—A survey of this portion of the New River was made in 1872. A report was printed in the annual report of the Chief of Engineers for 1873. Two estimates were submitted—one looking to an improvement to facilitate the navigation by the keel-boats now used, at a cost of $100,000; the other contemplating a 3-foot steamboat navigation, to cost $1,000,000.

The first appropriation for the work was $15,000, August 14, 1876; but it was not made available until May 1877. As this appropriation was insufficient for a general improvement, it seemed necessary to confine what should be done at present to a limited portion of the river, and to that scheme which involved the least expense, viz., for the keel-boats now in use, it being the understanding that what is first done in the smaller improvement should be arranged with a view to its utilization and adaptation some future day, when the means provided shall suffice to enter upon the improvement of the river for light steamboats.

It seemed also expedient that the first portions of the river treated should be in the vicinity of New River bridge, in order to facilitate communication of at least a portion of the country through which the river flows with an existing outlet east and west—the Virginia and Tennessee Railroad—which is itself in connection with the whole system of rail and water intercommunication of the country.

It is expected that the work will be completed, as far as the funds available will allow, before the close of 1877.

| | |
|---|---|
| Amount appropriated by act approved August 14, 1876 | $15,000.00 |
| July 1, 1877, amount expended during fiscal year | 78.25 |
| July 1, 1877, amount available | 14,921.75 |
| 2061 Amount (estimated) required for completion of existing project | 85,000.00 |
| Amount that can be profitably expended in fiscal year ending June 30, 1879 | 50,000.00 |

F 7

IMPROVEMENT OF NEW RIVER, FROM THE LEAD-MINES, IN WYTHE COUNTY, VIRGINIA, TO THE MOUTH OF GREENBRIER RIVER, WEST VIRGINIA.

A survey of this portion of the New River was made in 1872, and a report submitted January 9, 1873, which may be found in print in the Annual Report of the Chief of Engineers for 1873, beginning at page 852. Two estimates were therein made for the improvement of the river.

The first looked to facilitating the navigation by the keel-boats now used, at a cost of $100,000. This was to be accomplished by constructing slight deflectors or dams of rock and brush, in order to concentrate the volume of the water and increase the depth over the shoals from the present average of about 12 inches to about 2 feet, which could be done without too much increase of velocity. And some of the falls which are almost always vertical and of an average height of about 4 feet, could be greatly improved by blasting sluices through them about 30 feet in width and of an average length of 50 feet. In many cases the falls have already natural chutes or sluices through them susceptible of a similar improvement.

But there is a strong demand for the introduction of steamboats on the river. Hence the second estimate, which was for a 3-foot steamboat navigation, to cost $1,000,000. It was supposed that light-draught steamboats could, for short distances, ascend a grade of 1 in 400, with a current of 5 miles an hour. It was therefore proposed to excavate sluice-ways 80 feet wide and 3 feet deep through all shoals having a grade not exceeding 1 in 400. Where the grade exceeds this, low regulating dams were proposed, with sluices having a fall not exceeding 1 foot at each. In several cases dams were to be introduced containing locks, and in two other places lateral canals.

The first appropriation made for this improvement was $15,000, August 14, 1876, but authority for its expenditure was not given until in May, 1877. As this appropriation was insufficient for a

general improvement, it seemed necessary to confine what should be done at present to a limited portion of the river and to that scheme which involved the least expense, viz, for the keel-boats now in use; it being the understanding that what is first done in the smaller improvement should be arranged with a view to its utilization and adaptation some future day, when the means provided shall suffice to enter upon the improvement of the river for light steamboats.

It seemed also expedient that the first portions of the river treated should be in the vicinity of New River Bridge, in order to facilitate communication of at least a portion of the country through which the river flows with an existing outlet east and west, the Virginia and Tennessee Railroad, which is itself in connection with the whole system of rail and water intercommunication of the country.

Captain J. W. Cuyler, Corps of Engineers, has been assigned to the immediate supervision of this work, which is expected to be completed, as far as the available funds will allow, before the close of 1877.

MONEY STATEMENT

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|---|---|
| Amount appropriated by act approved August 14, 1876 | $15,000.00 |
| July 1, 1877, amount expended during fiscal year | 78.25 |
| July 1, 1877, amount available | 14,921.75 |
| Amount (estimated) required for completion of existing project | 85,000.00 |
| Amount that can be profitably expended in fiscal year ending June 30, 1879 | 50,000.00 |

2952 *Government exhibit 34*

REPORT OF THE CHIEF OF ENGINEERS, YEAR 1878

(pp. 69; 495–499)

8. Improvement of New River, from Lead Mines in Wythe County, Virginia, to mouth of Greenbrier River, West Virginia.—The plan adopted for the improvement of this river contemplates a channel-way 30 feet wide and 2 feet deep below the lowest water, suited for the keel-boats now in use, but at the same time capable of utilization and adaptation, at some future day, in a further improvement of the navigation for light steamboats, should means be provided therefor.

The season's work was commenced at the bridge of the Atlantic, Mississippi, and Ohio Railroad, and carried continuously upstream toward the lead mines, 9 miles, as far as Falls Branch Falls, resulting in the removal of all obstructions in that portion of the river to the adopted depth and width. The work was done by hired labor, and the purchase of material in open market.

The ledges and detached bowlders were blasted out under water, and the debris scoured out of the channel and built into the facings and heads of the wing-dams and training-walls; the gravel shoals were excavated through, and materials made into the heartings of these constructions. By these means sluices and chutes, affording an unobstructed water-way, were made, without increasing insurmountably the velocity and volume of the water in them. The plan adopted has proved its capability to accomplish its design. It is, therefore, proposed, during the ensuing year, to continue it, with slight modifications, working still up the river, but on an enlarged scale, so as to open up fully another 10 miles of river.

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|---|---|
| July 1, 1877, amount available | $14,921.75 |
| Amount appropriated by act approved June 18, 1878 | 15,000.00 |
| | $29,921.75 |
| July 1, 1878, amount expended during fiscal year | 6,492.26 |
| July 1, 1878, amount available | 23,429.49 |
| Amount (estimated) required for completion of existing project | $70,000.00 |
| Amount that can be profitably expended in fiscal year ending June 30, 1880 | 35,000.00 |

F 8

UNITED STATES ENGINEER OFFICE,
CAMP NO. 1, FALLS BRANCH, NEW RIVER,
*Pulaski County, Virginia, July 1, 1878.*

GENERAL: I have the honor to submit herewith the annual report of operations for fiscal year ending June 30, 1878, for the work of river improvement under my charge temporarily.

Very respectfully, your obedient servant,

JAS. W. CUYLER,
*Captain of Engineers.*

Brig. Gen. A. A. HUMPHREYS,
*Chief of Engineers, U. S. A.*

IMPROVEMENT OF NEW RIVER FROM LEAD MINES IN WYTHE COUNTY, VIRGINIA, TO THE MOUTH OF GREENBRIER RIVER, WEST VIRGINIA

Having been assigned by my predecessor in charge of the work, Maj. W. P. Craighill, Corps of Engineers, to its local charge, June 28, 1877, I took station at New River Depot, Pulaski County, July 6, after having first visited Wytheville, in order to obtain some necessary information and make certain needed arrangements, proceeding thereupon to inaugurate the work.

The project of Major Craighill, which was to form a clear channel, 30 feet wide by 2 feet deep, below minimum low-water,

through the rock in place, constituting the "falls" and "ripples" in the river, and the coarse gravel constituting the "bars," such channel to be adapted to the existing navigation, i. e., "keel-boats" or batteaux, with an average carrying capacity of 8 tons, on a draught of water 21 inches, and to be so arranged as to be capable of utilization, in the more general and permanent project contemplated, for a channel 90 feet wide by 3 feet deep, suitable for light-draught steamers, having been approved by the Chief of Engineers, June 7, 1877, I made a reconnaissance of the
2954 portion of the river extending 20 miles above and 7 miles below the determined-upon initial point of the work, i. e., the bridge of the Atlantic, Mississippi and Ohio Railroad spanning New River, between July 1 and 15, 1877, with a view of fixing the several localities for work.

The engineering as well as local considerations, pointing to the advisability of carrying the work forward progressively entirely upstream, a gravel "flat" 16 feet long by 8 feet beam and a "stone-boat", with 4 canoes, were built; 2 keel-boats 50 feet long by 7 feet 9 inches beam, were hired for quarters and transportation; boats, tools, and supplies collected, and a working force organized by July 23, when work was begun on the four ripples next above the railroad bridge and distant from it from 200 to 600 yards.

The nature of the work involved, for the removal of the rock in place, blasting under water as the method of working; "juniper-drills" were decide upon, as from the overhanging of the ledges and the fact that the workmen had to stand in quick and strong water, in order to drill, suitable "churn-drills" would have proved too unwieldy and heavy; holes of 2 inches diameter were fixed on as best suited to the work, and these were drilled on an average 3 feet below bed, and spaced as nearly equally apart as the lay of the rock would permit, varying from 2 feet to 8 feet.

In view of the facts that the labor of the country composing the force was entirely ignorant of the method of handling dynamite or "giant-powder," and that I had not time before leaving Baltimore, my nearest point of supply for such explosives, to arrange for procuring them, I decided upon the use of the "Orange" blasting-powder, and after several experiments with tin cartridge-cases and gutta-percha and india-rubber patent tubing for same, finally selected the "pitch bag" cartridge, a cylindrical bag of close ticking, made around a wooden core, and immersed in a mixture of pitch and tar of the proper consistency, with a piece of "double-tape" fuse inserted in the mouth and choked, which selection was followed by the best results, not 1 per cent. of blasts failing, as due to the cartridge, during the two and one-half month's opera-
2955 tions of 1877. For the removal of the gravel-bars the pick and shovel were used.

Lying as the work did in a country sparsely peopled and relatively inaccessible, it became a necessity to feed and tent the entire working party. Working on the above plan, a party of 50 were worked during the season of 1877.

After finishing the four ripples above referred to to width and nearly the proper depth, and building training-walls and wing-dams at them with the rock excavated, a fifth ripple—a narrow ledge offering no serious obstruction—half-way between Ripple 4 and "Jones" (for reference to localities, vide survey-map of 1872), was cut through; a gravel-shoal 80 feet in length, opposite "Jones" was dug through, and lacking but a few inches of the requisite depth; a "gathering-dam," extending 110 feet up river, was put in, raising the water to the proper level without blasting, and the main work of the season reached the passage of Ingle's Falls 3½ miles above the railroad bridge.

These falls consist at head of eight distinct ledges of hard gneiss rock, running straight across the river, successively, for 600 feet, barring back a pool extending up 3½ miles, with from 9 feet to 3½ feet water in it; below these ledges for 350 feet extend large detached bowlders, through which the natural sluice winds with great velocity of flow, succeeded by a gravel-shoal 240 feet in width, the "falls" being terminated by another gravel-shoal 300 feet wide just above the broken-down piers of the old Virginia and Tennessee Turnpike Bridge, in themselves, as they stand, an obstruction to descending boats, which latter require the removal of certainly the westerly pier of the two; the stretch of river embraced in the "falls" is 1,010 yards, and the total fall in this distance 7.11 feet, the width of low-water bed at head being 700 feet, narrowing suddenly at the lower "gravel" to 530 feet. Three-fourths of this fall of 7.11 feet occurs in the upper 900 feet through rock; and the gravel-shoals below, as well as the generally rough and irregular nature of the entire bed of the lower section, are undoubtedly due to the abrupt change of slope in the bottom, occasioning all
2956 the particles brought down through the rock-falls to be dropped in the sinuosities of the natural sluice.

Through the entire course of these obstructions, a channel-way of the prescribed dimensions was formed, and from an examination made last month, after the experience of the ice and freshets of the winter and spring ice, there are no decided signs of the filling in of the cut through the "gravel."

The working section, at Falls Branch, 4½ miles above Ingle's Falls, was next commenced upon. This work, lying on the convex side of a deep horseshoe bend, consists at head of falls of five rock ledges running across the river; vertical fall 3 feet 6 inches succeeded below by deep pool of still water, cut diagonally

across as the river bends by longitudinal ledges, the lower section consisting of rock ledges, straight across, again terminated by an abrupt fall over a gravel-bed; fall in this lower section 4 feet to surface of pool extending up from "Ingle's"; width of low-water bed 900 feet narrowing to 670 feet in bend, and total length in river of the obstructions 1 mile. The rock here, a disintegrated slate, blasting but very badly, proved so troublesome, that but little progress was made, and on October 11, high water and cold weather setting in, work had to be abandoned for the season, and the property put in store at the railroad bridge.

The work of the season had been of a character before untried, and to a certain extent experimental, but what had been done having proven that the project adopted was fully capable of meeting the object held in view by it, with the exception of following invariably the natural sluices and channels, if the present work was to be utilized in the more general project proposed, the winter was devoted to preparing a complete outfit suitable in character for operating on a larger scale. The lack of "plant," transportation, tents, &c., had closely restricted the operations of 1877 by itself, even had there been no other reason to conduct the work tentatively, and a party of 50 was the maximum for advantageous working in the season of 1877. Plans were made for a special class of boats adapted to the work in hand, on which six boats were built, including a "crane-boat," with light machinery; and all preparations being complete by June 1, on
2957 June 14 the work of the season was begun, the delay being due to the unusual high stage of water in the river and constant violent rains. The completion of the "Falls Branch" section, the terminus of last fall, was taken in hand and is at date completed.

After the close of work on October 11, 1877, a small field-party made the necessary surveys for enlarged maps of localities worked at, which should show details and changes which the survey of 1872 did not exhibit.

On October 22, I made a series of gaugings of the river extending to October 30, the point selected being at and below Ingle's Falls, this point being chosen not so much with an eye to the regularity of river section, but because it was the most serious obstacle to navigation, on the line of the season, and was a characteristic type of that class of obstructions—the worst in the river—it was desired to ascertain, with as near a degree of approximation as the nature of the case would permit of, the amount of obstruction to steam navigation of the river.

The observations were made with tin ellipses, submerged to various depths, and wooden floats; and while numerous observa-

tions were made with all the care practicable, the nature of the stream itself and the particular locality rendered solutions within exact limits impossible. From the measurement and the formulas used, good approximate results were obtained, showing the mean velocity of the river at this point to be about 5¼ miles, and the discharge equal to about 900 cubic feet per second, with a gauge-reading of 7.75 inches. For a more complete solution a series of gaugings should be continued at various stages of the river, and a connection made with the more permanent gauge boards established in the lower New River, a mean distance of 100 miles below the site of this work, and referred to the Charleston (Kanawha) plane.

The above-given figures furnish all requisite information for immediate practical purposes; for more exact results, observations extending over some time and nicely conducted are required, so great and so sudden are the variations in the stages of this river, and so many anomalous features does its upper course of 128 miles present.

2958 The rocks passed through in excavating, consist mainly of the common limestones, often holding fine crystals of dog-tooth spar and slates.

At Ingle's Falls the rock was almost entirely a hard, tough gneiss. The limestones are often found partially disintegrated, and more often the slates, the latter, when lying in nearly horizontal beds, proving a very troublesome and costly bed to excavate, as involving quarrying after blasting, or blowing out in small fragments; the gravel in the river is large and may better be termed a "shingle." As a rule, the excavations have furnished about the necessary material for the dams, training-walls &c., in which no brush has as yet been worked, the inner constructions of this material, with stone by private parties, for special, local objects, and by the government of the States lately in rebellion, not having proved stable or satisfactory.

It is proposed in the further progress of the work, to use more extensively the gathering-dams and training-walls, as a means of securing the necessary depths, with a diminished amount of blasting; also to use, in certain cases, "giant-powder" as an explosive, and introduce the use of the churn-drill.

As a general description of this upper New River, it may be said to consist of a series of pools from 100 feet to 4 miles in length, with from 3 feet to 10 feet depth in them, some few points, "holes," showing 20, 30, and more feet. These pools are separated by ledges straight across or diagonal to the river, in groups of from 5 to 10. The total fall between pools rarely exceeds 7 feet, more often 3 feet or 4 feet, the actual vertical fall,

not frequent, at a single ledge scarce ever being more than 18 inches; in fact, the so-called "falls" should be more appropriately termed "rapids."

There are some stretches of river showing long shoals, not bars, of the coarse gravel, but the pools and rock ledges predominate, pockets of gravel being generally found in and at foot of the "rapids." With such a regimen any improvement made as to deepening and widening the channel introduces the new obstacle of largely-increased velocity and volume; so that though the main and more important navigation of this river must ever be that of descending boats, yet no scheme of improvement can
2959 fully meet the requirements of the case without considering and aiming to counteract this induced obstacle to navigation.

Appended with be found tabular statements exhibiting figures of work, localities of same, and gauge-readings for the season of active operations of 1877–'78.

From the first table in will be seen that the work has been done at figures considerably below the estimates of the report of 1873, the general lowering of prices for labor and supplies of course largely affecting this, as also the favorable season for work shown by the gauge-tables.

With a gauge reading of +12 inches, which is the usual river's stage from November 1 to May 15, operations of the kind being carried on are impracticable.

As to the amount of work to be done for either the 30 feet or 90 feet width of channel-way, the experience of the year leads me to conclude that the estimates, as set forth in the report of 1873, are below considerably the actual amounts required.

Sketches of the more important working sections, Ingle's Falls and Falls Branch, are appended.

DETAILS OF WORK DONE.1877–1878

| | | |
|---|---|---|
| Rock excavated and moved | cubic yards | 724 |
| Gravel excavated and moved | cubic yards | 775 |
| Number of holes drilled | | 1,044 |
| Number of feet of holes drilled | feet | 3,027 |
| Average depth of holes | feet | 2.9 |
| Average depth of hole (2 inches) drilled per day per drill | feet | 9.75 |
| Number of blasts fired | | 984 |
| Number of blasts missed | | 60 |
| Number of cartridges made | | 1,076 |
| Average charge of powder in each cartridge | pounds | 5 |
| Average loosening of rock per blast | yards | ¾ |
| Average cost of pitch-bag cartridge completed | | $0 19.5 |
| Average cost of rock excavation, including blasting, scowing away debris, and building same into training-walls, &c | per yard | $3.56 |
| Average cost of gravel for do | per yard | $0.70 |

STATEMENT SHOWING LOCALITIES OF WORK DONE 1877–'78 AS PER SURVEY-MAP OF 1872

| | Width across of ledge |
|---|---|
| 1. 200 to 600 yards above railroad bridge— | |
| Ripple No. 1 | 50 feet |
| Ripple No. 2 | 110 feet |
| Ripple No. 3 | 20 feet |
| Ripple No. 4 | 20 feet |
| 2. Ripple No. 5 between Ripple No. 4 and "Jones" | 20 feet |
| 3. Gravel shoal opposite "Jones" | 80 feet |
| | Total length of falls and rapids in river |
| 4. Ingle's Falls | ½ mile |
| Falls Branch | 1 mile |

MONEY STATEMENT

| | |
|---|---|
| July 1, 1877, amount available | $14,921.75 |
| Amount appropriated by act approved June 18, 1878 | 15,000.00 |
| | $29,921.75 |
| July 1, 1878, amount expended during fiscal year | 6,492.26 |
| July 1, 1878, amount available | 23,429.49 |
| Amount (estimated) required for completion of existing project | 70,000.00 |
| Amount that can be profitably expended in fiscal year ending June 30, 1880 | 35,000.00 |

2961 *Government exhibit 35*

REPORT OF THE CHIEF OF ENGINEERS, YEAR 1879

(pp. 79; 530–545)

11. Improvement of New River from the lead mines in Wythe County, Virginia, to the mouth of Greenbrier, West Virginia.—The work of the year has been in continuation of that of the preceding year and following the same plan, making a practicable channel-way for the keel-boats now running on the river, but keeping in view a more extended improvement for light-draught steamboats.

From July 1 to September 13, 1878, the work progressed well on the section of the river immediately above the bridge of the Virginia and Tennessee Railroad, the object being to bring that portion into close connection with a railway running east and west.

A very severe freshet in September, 1878, did so much damage that it was considered inexpedient to resume there, so nearly was the season closed.

For special reasons work was commenced in September, 1878, on the portion of the river immediately above the mouth of the Greenbrier River at Hinton, in West Virginia. This continued actively until near the end of November. Work was

resumed on the same section as early in 1879 as the state of the river permitted, viz., early in June.

| | |
|---|---|
| July 1, 1878, amount available | $23,429.49 |
| Amount appropriated by act approved March 3, 1879 | 12,000.00 |
| | 35,429.49 |
| July 1, 1879, amount expended during fiscal year | 19,125.01 |
| July 1, 1879, amount available | 16,304.48 |
| Amount (estimated) required for completion of existing project | 114,160.00 |
| Amount that can be profitably expended in fiscal year ending June 30, 1881 | 20,000.00 |

2962 F 11

IMPROVEMENT OF NEW RIVER FROM THE LEAD MINES IN WYTHE COUNTY, VIRGINIA, TO THE MOUTH OF GREENBRIER RIVER, WEST VIRGINIA

The plan adopted for this river has been the formation of a channelway 30 feet wide and 2 feet deep below the lowest water, suited for the keelboats now in use, but at the same time capable of utilization and adaptation at some future day, in a further improvement of the navigation for light steamboats, should means be provided therefor.

The ledges and detached bowlders have been blasted out under water, and the debris removed from the channel and built into the wing-dams and training-walls. The gravel shoals were excavated through and the materials placed in the hearts of the dams, &c. By these means sluices and chutes have been made, affording a good water-way, without insurmountably increasing the velocity and volume of the water in them. The work has been done altogether by hired labor, and the purchase of materials in open market.

Operations were confined to the section of the river above the crossing of the Virginia and Tennessee Railroad, under the personal supervision of Capt. J. W. Cuyler, Corps of Engineers, until September 13, 1878, when a very severe freshet occurred, causing a considerable loss of property, and doing some damage to the unfinished works. It was so late in the season that operations were not resumed on that section.

The appended report of Captain Cuyler gives a detailed description of them.

In August, 1878, it was decided to commence work at once on the section of the river immediately above the mouth of the Greenbrier, at Hinton, in West Virginia. These operations were placed under the immediate supervision of Assistant A. M. Scott, and vigorously continued until near the end of November. The

report of Mr. Scott, appended hereto, gives the details of the work. This was resumed in June, 1879, under the direction of Col. W. P. Smith, assistant engineer. The working season is short, as the river must be low, the water clear and not too cold.

June 3, a small force was at work on Greenbrier Shoals.
2963 June 18, a force was engaged upon the Blue Stone Shoals, and June 17, on Land Craft Shoals.

It is found necessary to increase the estimate for the completion of the work by the sum of $56,160. The reasons for this are that the original estimate was approximate, being based on insufficient data, though the best then attainable; and actual experience has shown the quantities involved and the extent of the work to be done greater than previously supposed.

MONEY STATEMENT

| | |
|---|---|
| July 1, 1878, amount available | $23,429.49 |
| Amount appropriated by act approved March 3, 1879 | 12,000.00 |
| | 35,429.49 |
| July 1, 1879, amount expended during fiscal year | 19,125.01 |
| July 1, 1879, amount available | 16,304.48 |
| Amount (estimated) required for completion of existing project | 114,160.00 |
| Amount that can be profitably expended in fiscal year ending June 30, 1881 | 20,000.00 |

REPORTS OF CAPTAIN JAMES W. CUYLER, CORPS OF ENGINEERS

1

UNITED STATES ENGINEER OFFICE,
*Baltimore, Md., July 3, 1879.*

MAJOR: Pursuant to your instructions to this effect, I respectfully submit herewith the annual report of operations, improvement of Upper New River, Virginia, for fiscal year 1878–'79, in so far as these fell under my immediate charge.

For this report I adopt and submit, hereto attached, the report of operations for the season of 1878, after July 1, of date March 15, 1879. This latter report brings the record of operations up to October 15, 1878, when the operations under my immediate charge closed, and the entire work was transferred by your orders to a new locality, 84 miles down-stream.

The report of March 15, 1879, will be found to cover all the details of my operations, as also my general views on certain points, which may have a practical bearing in any further prosecution of the work, and which seemed clearly indicated to me
2964 by the experience of two seasons' work upon the river.

After October 15, 1878, I transferred to others, by your orders, the immediate charge of this particular work.

In this connection, I avail myself of the opportunity afforded me to express recognition of the valuable services rendered by

my assistant in the office, Mr. William Costello, and by Messrs. Ranson and Gilliam, who acted as head overseers.

The plan adopted for this work was that of making a clear channel through all the obstructions in the river-bed, 2 feet deep below minimum low-water, 30 feet wide, for the now navigation of the stream—bateaux—to be later on enlarged to 3 feet depth and 90 feet width, for light steamboat navigation.

| | |
|---|---|
| Original estimated cost of the work as now being carried on | $100,000 |
| Whole amount appropriated since adoption of present project (First appropriation, August 14, 1876; last appropriation, March 3, 1879.) | 42,000 |
| Amount expended to date | 25,697 |

The original estimate is insufficient to carry out to completion the existing project. The reasons for this excess of cost are, firstly, that when the original estimate was made the data on which it was based were in themselves not sufficiently full to admit of a close estimate; and, secondly, because in the light of the actual experience had, both the quantities involved and the extent of the words are greater than at first estimated for by a considerable amount.

I estimate as the probable additional sum required for completion, $56,160. This sum covers 128 miles of river to be improved under present project, at the rate of $1,220 per mile, which the actual figures of the two working seasons show to be a safe estimate per mile at the lowest.

Amount, exclusive of former appropriations, required for entire and permanent completion, $114,160.

While the nature of this work does allow of a permanent completion, this same nature involves an expenditure annually for maintenance and repairs; the probable sum of this, as nearly as can be estimated in this case, is $4,000.

Amount that can profitably be expended during fiscal year 1879–'80, $20,000.

2965 No revenue collected and no statistics to show amount of commerce or navigation that would be benefited by completion; the completion would, it is confidently believed, create a considerable amount of both.

No abstracts of proposals or abstracts of contracts, the work being done entirely by the United States, with all purchases in open market.

I have the honor, sir, to remain, very respectfully, your obedient servant,

JAS. W. CUYLER,
*Captain of Engineers.*

Maj. W. P. CRAIGHILL,
*Corps of Engineers, U. S. C.*

2

UNITED STATES ENGINEER OFFICE,
*Baltimore, Md., March 15, 1879.*

MAJOR: I have respectfully to submit the following report of operations on the Upper New River, Virginia, for the season of 1878, the period of time so covered extending from July 1, 1878, to which date my annual report of operations for 1877–'78 brought up the record to October 15, 1878, when all operations whatsoever were brought to a close.

After July 1, the work of completing the then working section, Falls Branch, by completing its two upper subsections, Bucks Falls and Egypt Falls, was continued, as previous to that date. The monthly reports set forth fully the difficulties and disappointments attending this work, all delaying the completion of it till August 20, far beyond the estimated date for completion. The length in river of this Falls Branch working section aggregated 1 mile, over which almost continuously work of some kind was done. Next, minor obstructions at Egypt Ford, ¼ mile farther up stream, and at Woolwine's Island, 1 mile beyond latter, were removed, and the work completed hereat (for localities, vide survey map of 1872). August 21, also, was begun the work at the Peak Creek section, 4½ miles above the Falls Branch one. For a detailed description of this new section and the special difficulties
2966 of its work, I respectfully refer to the monthly reports.

The position required a large amount of work of a preparatory nature; indeed, this was the main amount, and it was accomplished; no large amount of work in addition was required to complete the section, with a channel 30 feet wide in the lower subsection of 2,900 feet of river length, and 20 feet wide in the upper of 3,600 feet, a total length of river of 6,500 feet covered by the obstructions. On the 13th of September, while the above work was not entirely completed as above indicated, a freshet unprecedented—27 feet high at Peak Creek—unexpectedly and abruptly terminated the season's operations, by washing away and destroying the camp with its plant for the work, and greatly endangering the lives of all the working force. Though this flood ran out rapidly, the river until December, when winter froze it tight, kept much too high for any operations. After the flood, examinations were made at all the several working sections to determine the effects of the flood upon the works, the results of which have been submitted to you in a special report. The detail maps of the season's operations completed in the office, the property collected together and put in repair, and, finally, all boated down to Hinton, W. Va., at mouth of Greenbrier River, a distance of 84 miles, to

which point, under your decision, operations were to be transferred in future as a base. Everything was closed up by October 15.

Appended are detailed exhibits expressed in figures; these show results satisfactory and gratifying in the improvement made over the corresponding figures of the season of 1877, due to a larger force, better organization, and adequate preparations, made in advance of beginning work, both as to the aggregates of work done and the several details of the same, the same general plan of operations being continued in both years. In no case did the preparations made the previous winter fail to meet their designed purpose.

The two bateaux built by informal contract drew but 5 inches of water, light, and with 3 tons load but 15 inches, answering entirely to the requirements of moving the force, stores, &c., from camp to camp, as also for reconnaissances, examinations, 2967 &c.; the craneboat, though she could not be used as much as was expected, owing to the obstructed channels rendering it impossible often to get her into position, lifted 2½ tons on a draught of 6 inches of water, with her legs or spuds down. This device did admirably, a slight change, only practice pointed out, was needed in decreasing the outward spread from sides of boat of these spuds. The stone and gravel boats, drawing 6½ inches light carried from 3 to 5 tons at a load on 16 inches of water, and, notwithstanding their weight, due to their solid construction, and the inevitable difficulty of handling such a style of boat in such a river as this, yet proved their efficiency, and went through a very trying (on them) season without any repairs being put on them; to make the plant on this line as perfect as it is possible to make it, they but require to be supplemented by a fleet of smaller boats—large strong canoes built with knees—carrying from ¾ to 1¾ tons on 12 inches of water, for use in the worst places.

The use of the churn-drill was introduced, but successfully only exceptionally; it was too unwieldy for one man to manipulate in such water, and experience confirmed that the jumper, with the 2-inch-diameter holes (for powder), first started with, was the best and cheapest system of drilling. Deeper holes, 3.75 feet (average) against 2.9 feet in 1877, were used, as it was found absolutely necessary to go below the grade of bottom as laid out, so as to get at completion the required depth; thus with an average charge (of powder), less than in 1877, 0.54 pound and 0.65 pound, more rock was moved per blast, 1 yard (cubic) against ¾ yard. Though considerably more labor was thus involved, yet the work per drill per day (average) increased from 9.75 feet, 1877, to 12.78 feet, 1878. Giant powder No. 2 was also introduced, and with such successful results as to indicate the advantage of using it almost exclusively in future work, provided proper arrangements be made, in Baltimore, in advance, to supply it regularly in small

quantities at a time. With this, 1¼-inch-diameter holes were used as ample, and only ⅓ pound cartridges (average); by it so used the rock was so riven along the seams that it could be easily hoisted out in large blocks by the craneboat; larger holes or
2968 cartridges were disadvantageous as pulverizing the rock too much; of course, with this explosive, good judgment in its use is indispensable to produce good results; not unfrequently, however, in this work, if the rock is without seams or planes of stratification, the ordinary blasting-powder will do the desired work.

With the satisfactory results above noted accomplished, it may be further added that these were accomplished in the face of an unfavorable season for river work; it did not fairly open till the last part of June, and after July 1 comprised but 57 days on work proper, against 60 such days in 1877, beginning then July 23 and closing October 11. The appended plotted gauge-readings show, too, that the river in 1878 did not fall below—6½ inches on gauge, and the average stage for the season was not less than—3 inches, with three distinctly marked high freshets, entirely suspending operations for their continuance of 2 or 3 days, while in 1877 the stage was as low as—13 inches, with an average of—8½ inches, and but one freshet of note. The bearing on the work of this stage for 1878, higher by 6 inches all through, and about 4 inches above the ordinary summer low-water stage, is best appreciated in considering that with a gauge-reading of +10 inches, work is very difficult, and with +18 inches absolutely impracticable, so that but small limits as to stage of river are afforded for advantageous working.

A study of the readings on the gauge-pegs established at each camp, as the work progressed up stream, but all carefully connected with and referred to the initial peg near railroad bridge, shows some anomalous features, due, it is believed, to special local conditions predominating at each locality; on no gauge did synchronous readings give corresponding levels for the water surface, the differences being as small as ⅜ inch and as large as 5½ inches, and apparently not governed by any period or other continuous and distinct law or ratio, but subject to unaccountable fluctuations; these suggest the difficulty of maintaining the same continuous grade for the bottom, when, in the progress of the improvement, long stretches of river came under treatment.

2969 To summarize: 13½ miles of river have been improved, at a round cost of $1,220 per mile; the last work—at Peak Creek Shoals—being at the obstruction which more effectually than any other, in the whole line of 19 miles up from initial point—railroad bridge—originally projected for improvement, estopped navigation in the low-water stages; the map shows

this, the natural channel running for ¾ of a mile over a gravel slope underlaid by flat rock no lower than 1 foot, with the river over 400 yards wide, and most of its water in the deep pools barred by ledges on the other (easterly) bank. As was to be expected, 4 to 6 inches of water was often alone available, and no loads at all could get over; add to this a fall of 13.479 feet in the 6,661 feet of obstructions in bed (the survey of 1872 gave 14.80 feet fall, but the new leveling is believed to be the correct one), and the difficulty and importance of the section demonstrate themselves.

The freshet of September 1878, undoubtedly went to impair much the improvement made, involving an expenditure of from $2,000 to $3,600 to do over work once completed; but with this, even, there has been a decided betterment of navigation effected. The fact, however, originally set forth must not be lost sight of—that if any marked benefit is to accrue from the improvement it must be extended up 5 miles—to make the 19 miles first projected—or to Mac's Creek, at a cost of $7,600 more. This point is in this region the down-stream boundary of an extensive and rich mineral-producing district, which is the main interest to be served by the improvement, and which alone can and would inaugurate fully use of it when once made. To utilize, then, the work already done commensurately with its cost, necessitates as immediate a completion to Mac's Creek as possible.

A review of two seasons' operations establishes certain general points, which seem to call for consideration here. The practicability of the original project has been fully proven, with the modification of abandoning the idea of selecting the present natural sluices to patch up, not only for the contemplated steam-navigation, but even for the bateau navigation and rafting.

2970 It is necessary, in my opinion, to adopt a more general and radical method to effect a permanent improvement than has heretofore been tried. With this in view, I recommend a free use of dams to collect into pools the water, which constructions should be much more elaborate than any heretofore attempted. Further application of the approved formula convinces me that 900 cubic feet per second is the maximum discharge of the river to be calculated upon in the yearly low stages. Generally, as low as 700 feet only will pass. The worst places invariably are where this constant volume discharges through a section enlarged by widening of the low-water bed. The mere rock ledges, per se, form a minor type of obstructions, as always they have above and below them pools more or less deep, and blasting through them readily gives a good sluice with regular grade. The velocity is certainly hereby injuriously affected; but low regulating dams or long training walls below always can be put in to better dis-

tribute, and thus rectify this induced obstacle to navigation. With the shoals and rapids the case is different. Here the simple go-ahead work of blasting down to a depth and clearing out obstructions is ineffective, as by as much nearly as the bottom is so lowered does the surface fall shortly afterwards. The supply of water must, firstly, be augmented by going up to the very head of the obstruction, probably 1, 2, or 3 miles up, and constructing the water-way by building out bodily from the banks low but solid dams, followed down stream by guide-walls. In such structures I should use largely brush in mats or bundles; for while the river does not carry in it much sediment, and the dams would generally find rock to rest on, yet it would allow of broad bases, and would make thus not only a cheaper but a more water-tight dam than rock alone.

I should project for future work more construction of this kind, much less blasting.

The new system, more like to a slack-water system, would probably entail a cost beyond that of the original estimate for this improvement, by reason of the greater quantities of work involved. The work, however, can be, and has been done, done at figures below that estimate. The proposed system would be un-
2971 questionably slow of execution, too slow for those requirements other than the engineering ones; the main dams, all requiring correct location, would necessitate a study of and acquaintance with the river throughout the year—a residence on it, by the engineer in immediate charge. In this country, where to move from point to point, to transport supplies, &c., is slow work at best, it is impossible for the engineer to properly manage works spread over any considerable stretches, and yet in any extended operations, to attain the desired execution, such spreading out is necessary, as 100 men to a locality and camp are about the advantageous working maximum. On this basis, working on the present plan, not more than $18,000 can be expended in one season, so short are these. Every preparation must be completed before work actually begins, as also the essential duty of examining and locating by permanent marks the works proposed for that season; this would require the maintenance of a small permanent party making surveys, maps, &c., and a large quantum of labor and exposure for the engineer.

For the river from Hinton up to Sifford, 64 miles, the open-river system of improvement will, I think, be found to be but partially applicable; the dimensions of the river and of the main falls will necessitate the construction, at these latter, of locks and dams; with the open sluices, some system of towing up ascending boats, by cables on the bottom, the motor being steam or air, located on the banks, or better, on large floats fixed in the

still upper pools, will, in my judgment, be found essential. The main feature of the present plan, that of low constructions, should in all cases be held in practice, as far as practicable. Experience, as developed by the universal fate of the work of the late Confederate States on this river (though this now seems to have been injudiciously located and poorly built), is adverse to anything like rigid structures, such as large timbers bolted down to the bed-rock, interfering with the free discharge of the waters, in the sudden and great freshets incident to this river, and which, as the country towards its headwaters becomes stripped of its forests and gradually opened to cultivation, must be looked
2972 for more frequently and of greater size, with periods of years to elapse.

That the proposed improvement will be of real and decided local benefit, I consider now proven. It, and it alone, can and will afford an adequate outlet for a region good agriculturally; and with ascertained workable mines of the ores of lead, zinc, coal, and iron, and a considerable lumbering district all favoring the building up of local manufacturing interests, an outlet alone is needed to put in motion at once a considerable and increasing trade. Statistics on these heads, in the present condition of things, it is impossible to give, as not existing. I have the honor, sir, to remain, in conclusion,

Very respectfully, &c.,

JAS. W. CUYLER,
*Captain of Engineers.*

Maj. W. P. CRAIGHILL,
*Corps of Engineers, U. S. A.*

TABULAR STATEMENT OF WORK DONE

| | | |
|---|---|---|
| Average force worked during season, men | number | 102 |
| Working days in season, on work, men | do | 57 |
| Rock excavated, moved (by boats), and built into constructions, or wasted, cubic yards | | 1,940 |
| Gravel excavated, moved (by boats), and built into constructions, or wasted, cubic yards | | 1,092 |
| Cost of rock work, as above specified | per cubic yard | $2.20 |
| Lead, in boats, from 50 yards to 200 yards. | | |
| Cost of gravel work, as ditto | | $0.61 |
| Amount of constructions | linear feet | 2,325 |
| Average base, 11 feet; height, 433 feet; slopes, 1½ B to 1 P, and 1 B to 1 P. | | |
| Holes drilled | linear feet | 8,734 |
| Average depths of holes | do | 3.75 |
| Average depth of holes drilled per day, per drill, 10 hours | do | 12.78 |
| Blasts fired | number | 2,219 |
| Misfires | do | 51 |
| Holes abandoned | do | 226 |
| Ratio of misfires to blasts | per cent | 2⅛ |
| Average charge powder, per cartridge | pounds | 0.54 |
| Average charge dynamite | do | 0.33 |

| | | |
|---|---|---|
| Average rock moved per blast | cubic yards | 1 |
| Cost complete of pitch-bag cartridge (cartridge 15 inches long over all, 13 inches of powder, 1 quart tar to 2 gallons pitch-mixture; diameter, outer, 1¾ inches, full) | | $0.175 |
| Explosives used, powder | pounds | 1,275 |
| Explosives used, dynamite | do | 235 |
| Fuse used | linear feet | 13,182 |
| Fuse length, average per cartridge—4 minutes' time | do | 5.8 |
| Cost of commissary department per day, per man | cents | 17⅛ |
| Ration per day: 1 pound pork, 2¼ pounds cornmeal, 1.08 pounds sugar, 5 pound coffee, vegetables. | | |

2973 REPORT OF MR. A. M. SCOTT, ASSISTANT ENGINEER

UNITED STATES ENGINEER OFFICE,
*Charleston, Kanawha County, West Virginia, May 26, 1879.*

COLONEL: The following report on the improvement of New River, immediately above Hinton (mouth of the Greenbrier), from the beginning of operations in September last to date, is respectfully submitted.

In compliance with your instructions, dated Hinton, August 23, 1878, received through Lieutenant Turtle, I went at once to that place to estimate and arrange for starting the work. Your instructions were, in effect, to plan to do the least possible at any one point compatible with the navigation of the steamer then building at Hinton by the New River Steamboat Company, so that as much of the river as possible might be gone over during the low-water season.

I found, by conferring with the directors of the company, that they were anxious to have improvements made as soon as possible that would enable them to run their boat up to the mouth of Lick Creek, about 22 miles above Hinton. This would open to navigation considerable fine farming country, and practically connect with the important Tazewell County road. As the small appropriation could not possibly be applied to advantage over a greater distance, I limited my investigations to that point, and it was finally thought best, owing to the lateness of the season and the need of economy in applying the money, not to attempt anything last fall above the foot of Bull's Falls, and a project and estimate for opening a preliminary channel up to that place (11 miles above Hinton) were submitted as soon as possible, and approved by you in letter dated September 5.

As to a description of New River above the mouth of the Greenbrier, the susceptibility to improvement for steam navigation, the characteristics of the beautiful and promising country through which it runs, I can add nothing to your quite full reports of December 1872 and January 1873, printed as Appendix T 29, of the Chief of Engineer's Report for 1873.

The work, as planned and partly carried out last season, consisted principally of blasting a channel 50 feet wide and about 2 feet deep at low-water, through the solid ledges of which
2974 the shoals are mainly composed. There were also many large detached pieces and bowlders to be removed either by a crane-boat or blasting, or both, and more or less smaller stone and gravel, best managed by hand.

The following is an abstract of the project and estimate approved by your letter of September 5:

| | |
|---|---|
| For a craneboat | $600.00 |
| For 1 batteau | 75.00 |
| For 3 skiffs | 75.00 |
| For tools and blasting material | 450.00 |
| For labor, including foremen, to be expended in blasting and removing by hand solid rock and loose stone at the different shoals, viz: | |
| Between the landing at Hinton and head of Greenbrier Shoals (mostly solid rock) | 1,375.00 |
| Pack's Ferry Shoals (bowlders) | 85.00 |
| Deer Lick and Blue Stone Shoals (bowlders and solid rock) | 530.00 |
| Land Crafts Ford and Shoal (solid rock) | 900.00 |
| Buffalo Shoal (bowlders and solid rock) | 165.00 |
| Gardner's Ledges (solid rock) | 490.00 |
| Ellis Shoal (bowlder and solid rock) | 245.00 |
| To operate craneboat 35 days, with a force of 11 men, including foremen, at $18 per day | 630.00 |
| For blacksmithing | 125.00 |
| For superintendence and contingencies | 800.00 |
| Amount of estimate | 6,545.00 |

Arrangements for beginning work, the procuring of tools, boats, blasting materials, &c., were made at once, and a force of hands got to work on the shoals between the landing and the foot of Greenbrier Shoal on September 7.

Operations were a good deal delayed by the unprecedented rise in the river, which on September 13 reached 20.20 feet above low-water at Hinton. At the mouth of Blue Stone River, 5 miles above, its highest point was 23.7 feet above low-water. This was from 5 to 6 feet higher than ever known before. It did much damage in the valley. At Upper or Old Hinton 16 buildings, several of them good frame houses, were carried away. The sawmill of Mills and Company, the only one then in operation in the place, was also seriously damaged.

The damage to the mill delayed us considerably about the building of the craneboat, and we did not succeed in getting it ready for work till October 12. The boat, as built, overran the estimate, costing, complete, $730. It is 48 by 17 feet, rigged with a good double-geared crab, capstan, spuds, and a strong four-
2975 pronged grapple of 5 feet reach. It proved to be well adapted to the work. Both it and the smaller crane sent down from the upper river did good service, and will be indispensable in future operations.

The boats, tools, camp equipage, &c., that had been in use by Captain Cuyler on the upper part of the river were received at Hinton October 13. As stated, the most of the work consisted in blasting. This was all under water, generally in a current so swift that breakwater-dams were necessary and could only be carried on to advantage in low, clear stages. The season was very unfavorable; besides the big flood of September, the work was frequently stopped by small rises and bad storms. Owing principally to so much of the work being in the water a good deal of trouble was had in getting hands, particularly after the weather turned cool, and we were finally obliged to send a number from Kanawha to keep up the force. From 40 to 75 men, distributed at different points, were kept employed whenever the weather and water would permit, till November 27, when we were obliged to suspend for the season. Nothing has been done in the river since, except to place three additional ring-bolts and remove a few particularly troublesome stones at Greenbrier Shoals.

The work was carried out substantially as planned, but at a greater proportional cost, up to the head of Blue Stone, and a considerable amount was done on Land Crafts, the next shoal above. We were unable to do anything above that point.

The following is a statement of the rock removed at the different shoals measured in piles, side walls, &c., after excavation:

| | Cubic yards |
|---|---|
| Between Hinton Landing and foot of Greenbrier Shoal (estimated) | 43 |
| On Greenbrier Shoals | 1,754 |
| On Pack's Ferry Shoal (estimated) | 12 |
| On Deer Lick Shoal | 227 |
| On Blue Stone Shoal | 221 |
| On Land Crafts Shoal | 437 |
| Total | 2,694 |

As appears, the greater part of the work was done on Greenbrier Shoals. This is a bad place, consisting of a series of solid ledges, beginning at the mouth of Greenbrier River and extending up 3,600 feet. The fall in this distance, Hinton gauge reading 3.30 feet per levels by Mr. Schoonmaker, was 7.20 feet.

2976 The work on this shoal exceeded my estimate a good deal, and there is still considerable work to be done on some of the ledges at straightening and widening the channel. The average cost not including outfit, boats, tools, &c., of all the excavation, measured in the pile, was a little over $2 per cubic yard. On Greenbrier Shoal, where the work was heavier and more connected, the cost was about $1.40 per yard.

Dynamite or giant powder was used almost exclusively, with very satisfactory results. It proved to be much better for the work than common powder.

The width of channel adopted, 50 feet, has been found by trial to be too narrow in places for the new steamer, and it will be necessary to increase it to about 75 feet at some points where the current is very swift or somewhat indirect. As a rule, though, it is thought 50 feet will answer present purposes.

As to slopes, depths, &c., but little was attempted at grading the chutes; and at several places it was found impracticable, under the plan pursued, to reduce the slope to less than about 1 in 130, and on a few of the ledges and falls it will be even steeper than this. With such grades, a depth of not more than about 2 feet (equal to an available low-water depth of about 18 inches) could be made; and this was finally adopted and worked for throughout.

By extending the side-walls somewhat, and the occasional use of short wing-dams (the rock excavated for channels was used for these purposes as far as it went), it is thought an available ordinary low-water depth, of from 20 to 22 inches, can be made at very reasonable expense.

Steamers will be obliged to "wind" through some of the chutes, and must be provided with steam capstans for this purpose. To facilitate the ascent of boats, the channel at the shoals was located next the shore as far as practicable; and at other points, where the current was too strong to be stemmed, ring-bolts were placed.

The steamboat company got their new boat, the Cecilia Miller, ready to run by the middle of December, and have since made several trips, during rather high stages of water, to the
2977 foot of Bull's Falls. They are unable though, when the Hinton gauge reads less than 3½ feet (corresponding to 2.60 feet above low water), to get above Land Crafts, the point reached by our work last fall.

The boat is a well built stern-wheeler, 100 by 20 feet, provided with a steam boiler, 8 by 30 inch cylinders, a steam capstan, and good machinery throughout. She draws, when light and under way, less than 12 inches. She is thought to be rather too large for the navigation intended, but is considered as having fully demonstrated the practicability of making this part of the river navigable for small light-draft steamers.

The benefit afforded to the lumbering interest, which is considerable and increasing, should also be noticed. Many of the old batteau channels and "notches" are so narrow and crooked that rafting is attended with a good deal of risk; our channels being wide enough for the rafts, will render the passage of the shoals comparatively safe.

The desirability of continuing the improvement up to the mouth of Lick Creek as soon as possible, has been referred to.

This, as stated, would benefit quite an extent of good farming country, notably the rich Crump's Bottom and Indian Creek districts, and connect with the Tazewell, Mercer, and Monroe County wagon-road. Between Land Crafts and the mouth of Lick, the principal points to be improved, mentioned in order going up, are Gardner's Ledges, Bull's Falls, War Ford Shoal, Crump's Ledges, and McDaniel's Falls. War Ford, which has a fall of about 8 feet in 1,000, is the most serious. It is thought a permanent winding-line or wire-rope will be advisable at this shoal, and some arrangement of this kind is likely to be found expedient at other points.

The additional expenditure necessary to complete the improvement, as begun, to the mouth of Lick Creek, I have estimated roughly at from $18,000 to $24,000.

My duties on the Kanawha Improvement made it necessary for you to employ a local superintendent, and I take pleasure in acknowledging the efficient services of Mr. T. Schoonmaker, assistant engineer, who acted in this capacity during the working season. From notes and sketches made by Mr. 2978 Schoonmaker, maps (five in number) of the shoals where work was done were made on a scale of 1 inch to 100 feet.

During the progress of the work, temporary gauges, referred to approximate low-water, were kept at various points on the shoals; these were finally connected with permanent bench-marks.

Agreeably with your instructions, and by permission of Lieutenant Turtle, I went to Hinton on the 19th instant and turned the records, property, and work generally, over to Col. William Proctor Smith, assistant engineer.

Very respectively, your obedient servant,

A. M. SCOTT,
*Assistant Engineer.*

Maj. WM. P. CRAIGHILL,
*Corps of Engineers, U. S. A.*

SURVEY OF NEW RIVER, FROM LEAD MINES, IN WYTHE COUNTY, TO THE MOUTH OF WILSON CREEK, IN GRAYSON COUNTY, VIRGINIA

UNITED STATES ENGINEER OFFICE,
*Baltimore, Md., January 10, 1879.*

GENERAL: In the river and harbor bill of June 18, 1878, was a requirement for an examination or survey of New River, Virginia, from the Lead Mines, in Wythe County, to the mouth of Wilson Creek, in Grayson County. A survey had been previously made (in 1872) of the portion of the river from the Lead Mines down to the mouth of the Greenbrier, at Hinton in West Virginia, and in 1874, in connection with the surveys of the central water-line, a

survey had been made of the part of the river from Hinton to the mouth of the Gauley, where the New and Gauley unite and form the Great Kanawha. The whole of the river, therefore, from the mouth of Wilson Creek to its mouth has been surveyed and mapped.

The New River rises in North Carolina and crosses the line between that State and Virginia nearly at the mouth of Wilson Creek, the initial point of the survey of 1878. After flowing in a general easterly direction from the mouth of Wilson Creek, it turns down again into Alleghany County, of North Caro-
2979 lina, whence it soon re-crosses into Virginia. The point of its junction with the Gauley, in West Virginia, is almost due north of the place of its crossing from North Carolina into Virginia.

The survey of this year was made in September by Col. W. Proctor Smith, lately of the Corps of United States Topographical Engineers. His report, dated January 10, 1879, and maps, prepared in this office, are forwarded; the report by mail, and the maps by express.

The portion of the river surveyed by him has a length of 62 miles. The survey was as complete as the money available allowed. Colonel Smith's report is quite full, and, together with the maps, gives much valuable information concerning the river, and the country through which it passes.

It appears, from a study of the regimen of the river, that there is an "abundance of water for any system of navigation that may be inaugurated."

Three estimates are presented for the improvements, as follows:

| | |
|---|---|
| 1. For a two-foot navigation for keelboats, with a channel not less than 30 feet wide, with tracking or towing paths at the falls and rapids | $115,000 |
| 2. For a steamboat navigation, with a channel 90 feet wide and not less than 3 feet deep, with a grade always less than 1 in 400, including 28 locks and dams | 1,200,000 |
| 3. For a five-foot steam navigation | 1,600,000 |

Very respectfully, your obedient servant,

WM. P. CRIGHILL,
*Major of Engineers.*

Brig. Gen. A. A. HUMPHREYS,
*Chief of Engineers, U. S. A.*

REPORT OF COL. WM. PROCTOR SMITH, ASSISTANT ENGINEER.

BALTIMORE, *January 10, 1879.*

COLONEL: I have the honor to submit the following report of a survey of New River, made last fall, under your directions, and with it the following maps, viz: Seven sheets of map of New

River, scale 1 inch to 800 feet; one tracing of map of New River, scale 1 inch to 5 miles; eleven sheets of profile of New River, scale 1 inch to 400 feet; one sheet of profile of New River, scale 1 inch to 4,000 feet.

The first maps exhibit the meanderings of the stream,
2980 its width and depth, as well as position of ledges, shoals, and falls, also topography. The second gives the outlines of the stream, on a smaller and more convenient scale. The third indicate the slope of the water surface, from the mouth of Wilson to the Lead Mines, on an exaggerated scale. The fourth, the same slope on one sheet, for greater convenience.

The maps are of such a scale, and the whole report written in such a manner, as to make the survey an extension of the one made, under your directions, by N. H. Hutton, in 1872, from the Lead Mines to the mouth of the Greenbrier.

Only so much of the river was surveyed as lies between the mouth of Wilson, in Grayson County, Virginia, and the Union Lead Mines, in Wythe County, Virginia, a distance by the course of the river of 62 miles.

An examination of this section was made, in 1874, by S. T. Abert, United States civil engineer, who described the country and river and reported thoroughly on its mineral and agricultural resources to the Chief of Engineers of the United States Army, January 7, 1875.

The party was organized and equipped on the 26th of August, at Wytheville, the county-seat of Wythe County, Virginia, 47 miles from the mouth of Wilson via Independence, the county-seat of Grayson County, Virginia. On the 28th of August it was in camp at Fox Creek, a few miles from the mouth of Wilson, ready for work, but owing to a rise in the river of 8 feet, operations were not commenced until the 2d of September, and finished October 1, at the Lead Mines.

Level and transit lines were run throughout the entire distance, determining the meanderings of the river, the slope of the water-surface, and the form and character of the obstructions. Numerous soundings were made, and sufficient topography taken for the purposes of the survey.

September the 12th, at the 18th mile, a sudden and unprecedented rise of the river took place; 18½ feet above ordinary low-water, and 7½ feet higher than the great flood of May 1840. At Samuel Cox's mill, below Peachbottom Creek, the rise was 22 feet.

New River is formed by two tributary streams, which rise in
the mountains of North Carolina and unite on the border
2981 of Virginia. The North Fork rises in Ashe County, the South Fork in Watauga County, and they flow together

4 miles above the mouth of Wilson, the initial point of this survey. From the latter point the river runs between the different ranges of the Blue Ridge and the Alleghany Mountains, in an easterly direction for 22 miles, and thence northeasterly to the terminus of the survey. The headwaters are 2,500 feet above tide-water; the country mountainous, the roads rough and sometimes impassable.

Throughout this distance, except where the river flows through the mountains, the valleys present some bottom-lands in places from one-half to three-quarters of a mile wide. The hills bordering on the river, however, are cultivated to their very summits.

Beginning of the mouth of Wilson, with a width of 300 feet and an average depth in the pools of 4 feet, the river gradually widens to 1,000 and 1,100 feet, and contracts again to the width of 450 feet, and an average depth in the pools of 5 feet at the Lead Mines.

Between the mouth of Wilson and the Lead Mines, several streams of no inconsiderable size empty into New River; among them, from the south and east, are Potato, Carolina-Elk, Meadow, Chestnut, and Crooked Creeks, and Little River; from the north and west, Fox, Saddle, Bridle, Peachbottom, Elk, Eaglebottom, Surgener, Brush, Snowhill, and Cripple Creeks, and Bull Run. All of these are mountain streams, furnishing from 25 to 200 cubic feet of water per second, at ordinary stages.

The drainage area of the river, within the limits of the survey, amounts to 900 square miles.

The river during a portion of the time of this survey was down to what the inhabitants call summer water, but they had known it 3 or 4 inches lower. The stream, however, was sufficiently low for the results of observation for velocity and quantity of water to be relied upon. The discharge indicated 2 miles below the mouth of Wilson was 1,200 cubic feet per second; and 1,800 cubic feet per second at a point 4 miles above the Lead Mines. These results show that the stream affords abundance of water for any system of navigation that may be inaugurated.

As is usual with mountain streams, this river presents
2982 pools of comparatively deep and still water, separated by rapids, shoals, and falls. The water flows in the pools at about the rate of 1 mile per hour; over the rapids at about the rate of 3 miles per hour, and over the falls at about the rate of 5 miles per hour. The depth usually, over the falls, is from 9 to 12 inches; frequently, however, obstructions are formed below, by bowlders, which increase this depth to 2 feet.

Throughout this survey the pools are very short, whole miles being composed of ledges of gray and blue granite or slate, a

few hundred feet apart, with very short pools between. Only five pools of a mile in length in this portion of the river.

The total fall in the river from the mouth of Wilson to the Lead Mines is 507 feet, or about 8⅙ feet per mile; a grade, although very heavy, that, if distributed equally throughout the entire distance, would not present an insuperable obstacle to the navigation of the stream.

The obstructions to navigation consist of solid flat rock on the bottom of the river, loose rock, gravel, and sand; ledges over which the water flows, those which scarcely disturb the surface, and collections of bowlders, showing many feet above the surface.

The ledges encountered for the first 20 miles of this survey are composed of gray granite almost entirely; for the next 30 miles this same rock, called by the inhabitants gray river rock, largely predominates, interspersed with blue granite or slate, soap and sandstone, and some gneiss and ferruginous rock; for the last 5 miles the ledges are almost exclusively limestone. In a great many instances these deposits are distorted and upheaved in such a manner as to make their removal easy by blasting.

The following statement of the obstructions met with in each mile will give a good idea of the work necessary for the improvement of the river. The stream elsewhere than where these obstructions prevail affords a good navigation of 4 feet at low stages.

Commencing at the mouth of the Wilson, with an elevation above tidewater of 2450.9 feet, four shoals, over gray granite ledges, are to be found in the—

2983 First mile.—One at ford, 300 feet long, fall 3 feet; one 100 feet long, no fall; one 800 feet long, loose rock, fall 1.8 feet; and one 300 feet long at ford, fall 1.1 feet. Fall in the mile 7.74 feet.

Second mile.—Elevation 2443.16 feet, one shoal 100 feet long, no fall; slight rapids, flat rock bottom for 2,450 feet, fall 3.6 feet. Fall in the mile, 6.47 feet.

Third mile.—Elevation 2436.69 feet; Fox Falls, 2.55 feet in 150 feet, over 2 ledges of solid rock; one fall .6 foot in 75 feet; and rocky shoal 400 feet long, fall 1 foot. Fall per mile 5.76 feet.

Fourth mile.—Elevation 2430.93 feet; one slight shoal 2000 feet long; fall 1.4 feet. Fall in the mile 3½ feet.

Fifth mile.—Elevation 2427.3 feet; one shoal full of bowlders, 1550 feet long, 2.2 feet fall; one shoal 300 feet long, no fall; one fall .7 foot in 100 feet. Total fall 4.53 feet.

Sixth mile.—Elevation 2422.90 feet; one shoal 2000 feet long, bowlders at Cedar Island, flat-rock bottom, fall 6.88 feet; one shoal 300 feet long, fall 1.2 feet. Total fall 10.57 feet.

Seventh mile.—Elevation 2412.33 feet; one shoal 250 feet long, full of bowlders, fall .4 foot; slightly shoal for 2600 feet, bowlders, fall 3.9 feet. Total 6.91 feet.

Eighth mile.—Elevation 2405.42 feet; good water; one ledge, 1 foot high, extends ¾ way across the stream. Fall in the mile 2.83 feet.

Ninth mile.—Elevation 2402.59 feet; fall of 1 foot in 50 feet, good soundings over it, and there smooth water; one shoal 300 feet long, no fall. Total fall 2.83 feet.

Tenth mile.—Elevation 2399.76 feet; Osborne's Falls consisting of a succession of ledges, from 6 inches to 18 inches, over which the water falls nearly vertical; 1st fall 8 feet in 1200 feet, then pool 1100 feet long; 2d fall, 7½ feet in 600 feet, then rapids, with deep water, but full of bowlders, fall 1½ feet; 3d fall, 3¼ feet in 200 feet. Fall in the mile 20¾ feet.

Eleventh mile.—Elevation 2379.01 feet; good water for 2984 600 feet; balance wide and shoal; shoal between island and mainland; gravel and loose rock. Total fall 7.36 feet.

Twelfth mile.—Elevation 2371.65 feet; one ledge 50 feet long; fall ½ foot; one shoal 500 feet long, full of bowlders; 2 ledges; fall 2 feet; shallow between island and mainland; one fall .8 foot in 50 feet; one shoal 800 feet long, full of bowlders, at Elk Creek Ford; fall 3½ feet. Fall in the mile 9.44 feet.

Thirteenth mile.—Elevation 2362.62 feet; bowlders at island; one 500-foot shoal at Horse Ford, flint rock and flat bottom; .6 foot fall; fall of 2½ feet in 250 feet; one shoal 450 long; fall .4 foot. Total fall per mile, 7.84 feet.

Fourteenth mile.—Elevation 2354.37 feet; one shoal 500 feet long; fall .6 foot; one slight shoal 800 feet long; fall 3 feet; one shoal 400 feet long; fall 1 foot. Fall per mile 6.8 feet.

Fifteenth mile.—Elevation 2347.57 feet; slight shoal 1700 feet long; fall 3 feet; river broad, shoal and rapids for 1450 feet; 3 feet fall. Fall per mile 7.41 feet.

Sixteenth mile.—Elevation 2340.16 feet; rapids and fall at beginning over blue granite or slate; fall 3 feet, balance good water; gravel bottom, some sand islands. Total fall per mile 5.68 feet.

Seventeenth mile.—Elevation 2334.48 feet; commences with good water; then shoal 1600 feet long at Doughton's and Middle Ford. Total fall 4.38 foot.

Eighteenth mile.—Elevation 2330.10 feet; at beginning shoal for 400 feet, at Taliaferro's Ford; fall 1 foot; then pool, and at end shoal 750 feet long; fall 3.3 feet. Fall per mile, 7.03 feet.

Nineteenth mile.—Elevation 2323.07 feet; good navigation. Fall per mile 2.71 feet.

Twentieth mile.—Elevation 2320.36 feet; good water. Fall per mile 6.82 feet.

Twenty-first mile.—Elevation 2313.54 feet; one shoal 1700
2985 feet long; fall 4 feet; one shoal 1600 feet long; fall 3 feet
Fall per mile 7.55 per feet.

Twenty-second mile.—Elevation 2305.99 feet; rapids for 300 feet; 1.3 feet fall; 2 slight shoals, 400 feet long each; balance pool. Fall per mile 5.79 feet.

Twenty-third mile.—Elevation 2300.20 feet; shoal 175 feet long; fall 2 feet; at Peachbottom Creek and Cox's Ford, slightly shoal for 2400 feet, water smooth and still. Fall per mile 4.94 feet.

Twenty-fourth mile.—Elevation 2295.26 feet; rapids for 250 feet, good water, however; balance pool. Total fall 6.2 feet.

Twenty-fifth mile.—Elevation 2289.6 feet; rapids for 100 feet; falls .4 foot; rapids and falls for 700 feet; 2.7 feet fall; balance good water. Total fall 5.19 feet.

Twenty-sixth mile.—Elevation 2283.87 feet; mouth of Little River, shoal for 800 feet. Total fall 2.61 feet.

Twenty-seventh mile.—Elevation 2281.26 feet; pool 2200 feet long; one shoal 300 feet long; ½ foot fall; pool 1200 feet long; balance flows rapidly. Total fall 5.16 feet.

Twenty-eighth mile.—Elevation 2276.10 feet; 900 feet shoal at Collins's old ford; fall 1.8 feet; balance good water. Fall per mile 4.17 feet.

Twenty-ninth mile.—Elevation 2271.93 feet; pool for 3300 feet; shoal for 2000 feet. Total fall 4.97 feet.

Thirtieth mile.—Elevation 2266.96 feet; shoals and pools about equal. Fall in the mile 6.44 feet.

Thirty-first mile.—Elevation 2260.52 feet; one shoal for 200 feet and another for 800 feet; fall 8 feet. Fall in the mile 3.24 feet.

Thirty-second mile.—Elevation 2257.28 feet; Island Ford, rapids for 700 feet; 2.3 feet fall; one small vertical fall and then rapids for 400 feet. Total fall 5¾ feet.

Thirty-third mile.—Elevation 2251.53 feet; rapids for 800 feet, then succession of short rapids and pools, and a fall of 1½ feet in 200 feet. Total fall 8.05 feet.

2986 Thirty-fourth mile.—Elevation 2243.48 feet; one shoal 1000 feet long; fall 2 feet; one shoal 600 feet long; fall 1 foot. Fall per mile 4.31 feet.

Thirty-fifth mile.—Elevation 2239.17 feet; one shoal 200 feet in length; one shoal 1000 feet long and rocky. Fall per mile 3.35 feet.

Thirty-sixth mile.—Elevation 2235.82 feet; for 800 feet rocky and rough, but good water; one shoal 500 feet long. Fall in the mile 3.86 feet.

Thirty-seventh mile.—Elevation 2231.96 feet; good water. At end very wide; some sand islands. Total fall 3.37 feet.

Thirty-eighth mile.—Elevation 2228.59 feet; slightly shoal for 1200 feet; fall 1.6 feet one shoal 150 feet long. Fall per mile 3.38 feet.

Thirty-ninth mile.—Elevation 2225.21 feet; one shoal 500 feet long; 1.3 feet fall; balance good water. Total fall 4.6 feet.

Fortieth mile.—Elevation 2220.61 feet; good navigation. Fall per mile 5.31 feet.

Forty-first mile.—Elevation 2215.30 feet; one shoal 800 feet long at Garrison's Ford. Total fall 2.18 feet.

Forty-second mile.—Elevation 2213.12 feet; good water. Fall per mile .9 foot.

Forty-third mile.—Elevation 2212.22 feet; at end Boone's Ford; quite wide, shoal for 2400 feet, and in it a fall of 1 foot in 200 feet. Total fall 4.76 feet.

Forty-fourth mile.—Elevation 2207.46 feet, Bull Run Falls; one fall 1.2 feet in 450 feet and rapids 1600 feet long; then a fall of 1 foot in 400 feet, and rapids for 300 feet with 1 foot fall; then water flows over 3 ledges and rapids for 1700 feet, full of bowlders; fall 9½ feet. Fall per mile 16.1 feet.

Forty-fifth mile.—Elevation 2191.36 feet; 1 foot fall in 450 feet; pool 1300 feet long; 3 ledges and rapids, Mallory's Falls for 1700 feet; fall 12 feet; then pool for 1800 feet. Total fall 15.98 feet.

Forty-sixth mile.—Elevation 2175.38 feet; 3 falls and rapids; De Priest's 1900 feet long; fall 14 feet; then rapids for 1400 feet; Bartlett's Shoals and Rapids, at end, 1750 feet long; 6 feet fall. Fall per mile 21.15 feet.

Forty-seventh mile.—Elevation 2154.23 feet; 1750 feet
2987 full of rock and some gravel, but good water; 6½ feet fall; one shoal 300 feet long, also some sand islands; balance pool. Fall per mile 10.45 feet.

Forty-eighth mile.—Elevation 2143.78 feet; good water. Total fall 1.3 feet.

Forty-ninth mile.—Elevation 2142.48 feet; good navigation for 2700 feet; then Dickinson's Shoals and Ford for 2600 feet; fall 5½ feet. Fall per mile 6½ feet.

Fiftieth mile.—Elevation 2135.98 feet; Dickinson's Rapids and Falls, a succession of heavy falls and rapids with three short pools. Fall for the mile 25.66.

Fifty-first mile.—Elevation 2110.32 feet; Surgener's Rapids and Falls; 3 falls and 3 short pools. Fall in the mile 22¾ feet.

Fifty-second mile.—Elevation 2087.57 feet; 700 feet lower portion of Surgener's Falls; pool 1800 feet long; fall 2½ feet; ends in Dowling's Falls and Rapids. Fall in the mile 15¾ feet.

Fifty-third mile.—Elevation 2071.82 feet; Grayson's Springs, Shoals, Rapids, and Falls; consisting of 4 shoals, 3 short pools, and 1 small fall at end. Fall in the mile 21.79 feet.

Fifty-fourth mile.—Elevation 2050.03 feet; fall ½ foot in 50 feet; shoal for 600 feet; fall 2½ feet; then the Gulf, consisting of rapids and two falls, in all 10 feet; very rough and full of bowlders. Total fall 11.65 feet.

Fifty-fifth mile.—Elevation 2038.38 feet; good water; Allen's Ferry. Fall per mile 10.80 feet.

Fifty-sixth mile.—Elevation 2027.58 feet; Early's Shoals, 500 feet long; fall 2.8 feet; pool 2500 feet long to beginning of Wilkinson's Falls. Total fall 1645 feet.

Fifty-seventh mile.—Elevation 2011.13 feet; Wilkinson's Rapids and Falls. Throughout this mile, water very swift, full of bowlders, loose rocks, and ledges entirely across the river. Fall per mile 28.05 feet.

Fifty-eighth mile.—Elevation 1983.08 feet; one shoal 800 feet long; fall 5 feet; one shoal 1100 feet long; fall 4 feet. Foot of Ewing's and Poplar Camp Mountains; limestone commences here. Total fall 16.40 feet.

2988 Fifty-ninth mile.—Elevation 1,966.68 feet; shoal for 2,600 feet; fall 6 feet; balance good water. Total fall 9¾ feet.

Sixtieth mile.—Elevation 1,956.93 feet; a ledge for 50 feet, and a fall of 1½ feet in 300 feet, but deep water; remainder of mile good water. Total fall 3.45 feet.

Sixty-first mile.—Elevation 1,953.48 feet; good navigation. Fall per mile 2.70 feet.

Sixty-second mile.—Elevation 1,950.78 feet; shoal 900 feet long and 3 ledges; fall 3 feet; 2 other ledges, but good water over them. The survey is 62 miles and 566 feet, but for convenience the feet are included in the last mile. The estimate is made for a lock and dam at the Lead Mines; the channel, however, between the island and the left bank of the river can be cut out to the proper width and depth, if desirable. Fall per mile 6.92 feet; elevation at top of dam 1,946.23 feet; elevation at foot of dam 1,943.86 feet.

After a careful examination of the map and profile, it is considered possible to improve the river to and including the 43d mile by the usual methods of excavation and lateral dams, with the exception of Osborn's Falls, where locks and dams will have to be introduced. Slack-water navigation will also have to be made for the next 14 miles through the mountains; from the base of these to the terminus, 5 miles, but slight work will be required.

The improvement of this portion of the river must be considered as a whole. It is not possible to divide it into sections and treat such separately with regard to lateral means of transportation, by railway or otherwise, for no such means exist.

Perhaps the best method of improvement that can be used in the wide, and of consequence shoal portions of the river, is to build

dams to concentrate a sufficient quantity of water into the channel, and then to reduce the grade and velocity by the use of low regulating-dams with sluices in them. At present this portion of the river is not used at all for transportation purposes. Only the ordinary canoe is seen, and it is merely used for ferrying and
2989 fishing. For keel-boat navigation a channel 2 feet deep and 30 feet wide, with tracking or towing paths at the falls and rapids, will answer all purposes.

Rock excavation, removing bowlders, sand, and gravel, and building lateral dams will cost for the—

| | |
|---|---|
| 62 miles, at an average of $1,200 per mile | $74,400 |
| 20,300 linear feet of towing-path, at $2 | 40,600 |
| Total | $115,000 |

The resources of the country are such, however, as to require a steamboat navigation. For this a channel 3 feet deep and 90 feet wide, with a grade always less than 1 foot in 400 feet, it is thought, will suffice. A channel less wide could be used, but the velocity would be much increased.

The locks and dams are to be of crib-work filled with stone, for which an abundance of material is found all along the river. The estimate for the locks is based on that of an 8-foot lift, with 4 feet depth on the miter-sills, costing $11,500; and of the following dimensions: walls, 11½ feet wide and 17 feet high; chambers, 25 feet wide and 120 feet long; total length, including lower wings, 175 feet; total width, 48 feet.

The dam corresponding to a lock of the above description is estimated as having a width of 16 feet, a front 12 feet high, and a back 8 feet high, with supporting walls 8 feet apart longitudinally. Top covered with 3-inch plank, and at the crest an ice-breaker 3 inches thick and 6 feet deep. Estimated cost per linear foot, $20. Each abutment is estimated as equal in cost to 55 linear feet of dam. The smaller dams are estimated at an average height of 6 feet, with a width at base of 12 feet.

The proposed locks and dams are shown in red on the maps. All shoals not otherwise marked are indicated to have sluice-ways cut through them.

Owing to the large rain-fall and extensive rises in the river during the progress of this survey, and the limited time to be devoted to it, it was found impossible to locate accurately the locks and dams mentioned as a part of the suggested system of navigation. Sufficient data, it is believed, however, was obtained to make the estimate submitted below, for a 3-foot navigation, nearly correct.

2360 TABLE SHOWING THE ESTIMATED COST OF EACH MILE FOR 3-FOOT NAVIGATION

| | | | |
|---|---|---|---|
| First mile | $13, 800 | Thirty-third mile | $8, 500 |
| Second mile | 4, 400 | Thirty-fourth mile | 9, 500 |
| Third mile | 7, 000 | Thirty-fifth mile | 6, 800 |
| Fourth mile | 4, 300 | Thirty-sixth mile | 3, 200 |
| Fifth mile | 15, 300 | Thirty-seventh mile | 5, 000 |
| Sixth mile | 36, 500 | Thirty-eighth mile | 3, 000 |
| Seventh mile | 8, 700 | Thirty-ninth mile | 2, 500 |
| Eighth mile | 700 | Fortieth mile | 0, 000 |
| Ninth mile | 3, 700 | Forty-first mile | 4, 000 |
| Tenth mile | 59, 600 | Forty-second mile | 0, 000 |
| Eleventh mile | 12, 300 | Forty-third mile | 13, 200 |
| Twelfth mile | 10, 400 | Forty-fourth mile | 48, 300 |
| Thirteenth mile | 10, 600 | Forty-fifth mile | 51, 600 |
| Fourteenth mile | 15, 700 | Forty-sixth mile | 43, 400 |
| Fifteenth mile | 18, 000 | Forty-seventh mile | 38, 800 |
| Sixteenth mile | 10, 600 | Forty-eighth mile | 00, 000 |
| Seventeenth mile | 6, 400 | Forty-ninth mile | 13, 900 |
| Eighteenth mile | 10, 500 | Fiftieth mile | 75, 800 |
| Nineteenth mile | 00, 000 | Fifty-first mile | 78, 400 |
| Twentieth mile | 00, 000 | Fifty-second mile | 44, 100 |
| Twenty-first mile | 16, 900 | Fifty-third mile | 44, 400 |
| Twenty-second mile | 6, 000 | Fifty-fourth mile | 35, 000 |
| Twenty-third mile | 11, 500 | Fifty-fifth mile | 00, 000 |
| Twenty-fourth mile | 4, 100 | Fifty-sixth mile | 57, 800 |
| Twenty-fifth mile | 7, 000 | Fifty-seventh mile | 81, 800 |
| Twenty-sixth mile | 7, 000 | Fifty-eighth mile | 50, 500 |
| Twenty-seventh mile | 2, 100 | Fifty-ninth mile | 13, 200 |
| Twenty-eighth mile | 4, 600 | Sixtieth mile | 2, 500 |
| Twenty-ninth mile | 7, 100 | Sixty-first mile | 0, 000 |
| Thirtieth mile | 14, 900 | Sixty-second mile | 21, 100 |
| Thirty-first mile | 11, 200 | | |
| Thirty-second mile | 4, 500 | Total | 1, 101, 700 |

The amounts in the following table are included in the table for estimated cost per mile.

TABLE SHOWING THE ESTIMATED COST OF EACH LOCK AND DAM FOR 3-FOOT NAVIGATION

The abutments are regarded as a part of the dam, and included in its estimate, but the table shows the actual length of dam without abutments)

| No. of locks | Location | Lift of lock | Cost | Linear feet in dam | Cost | Total |
|---|---|---|---|---|---|---|
| | | Feet | | | | |
| 1 | Osborne's Falls, tenth mile | 8 | $11, 500 | 270 | $7, 600 | $19, 100 |
| 2 | do | 7 | 11, 000 | 290 | 7, 600 | 18, 600 |
| 3 | do | 5 | 10, 000 | 370 | 8, 200 | 18, 200 |
| 4 | Bull Run Falls, forty-fourth mile | 10 | 12, 500 | 540 | 24, 500 | 37, 000 |
| 5 | Mallory Falls, forty-fifth mile | 7 | 11, 000 | 700 | 15, 600 | 26, 600 |
| 6 | do | 5 | 10, 000 | 670 | 13, 300 | 23, 300 |
| 7 | De Priest's Falls, forty-fifth mile | 8 | 11, 500 | 450 | 11, 200 | 22, 700 |
| 8 | do | 6 | 10, 500 | 350 | 8, 300 | 18, 800 |
| 9 | Bartlett's Rapids, forty-seventh mile | 10 | 12, 500 | 890 | 22, 200 | 34, 700 |
| 10 | Dickinson's Falls, fiftieth mile | 10 | 12, 500 | 590 | 15, 400 | 27, 900 |
| 11 | do | 6 | 10, 500 | 510 | 11, 200 | 21, 700 |
| 12 | do | 9 | 12, 000 | 430 | 11, 300 | 23, 300 |
| 13 | Sergener's Falls, fifty-first mile | 10 | 12, 500 | 490 | 13, 200 | 25, 700 |
| 14 | do | 9 | 12, 000 | 450 | 11, 700 | 23, 700 |
| 15 | do | 7 | 11, 000 | 430 | 15, 200 | 26, 200 |
| 16 | Dowling's Falls, fifty-second mile | 9 | 12, 000 | 450 | 11, 700 | 23, 700 |

TABLE SHOWING THE ESTIMATED COST OF EACH LOCK AND DAM FOR 3-FOOT NAVIGATION—Continued

| No. of locks | Location | Lift of lock | Cost | Linear feet in dam | Cost. | Total |
|---|---|---|---|---|---|---|
| 2991 | | Feet | | | | |
| 17 | Grayson Spring Falls | 6 | $10,500 | 370 | $8,700 | $19,200 |
| 18 | Grayson Spring Falls, fifty-third mile | 7 | 11,000 | 330 | 8,400 | 19,400 |
| 19 | Do | 10 | 12,500 | 370 | 10,500 | 23,000 |
| 20 | The Gulf Falls, fifty-fourth mile | 10 | 12,500 | 490 | 13,200 | 25,700 |
| 21 | Wilkinson's Falls, fifty-sixth mile | 8 | 11,500 | 300 | 8,200 | 19,700 |
| 22 | Do | 9 | 12,000 | 660 | 15,700 | 27,700 |
| 23 | Wilkinson's Falls, fifty-seventh mile | 8 | 11,500 | 790 | 18,000 | 29,500 |
| 24 | Do | 7 | 11,000 | 650 | 14,500 | 25,500 |
| 25 | Do | 7 | 11,000 | 490 | 11,400 | 22,400 |
| 26 | Wilkinson's Falls, fifty-eighth mile | 8 | 11,500 | 340 | 9,000 | 20,500 |
| 27 | Do | 5 | 10,000 | 400 | 8,700 | 18,700 |
| 28 | At Lead Mines, sixty-second mile | 6 | 10,500 | 450 | 10,100 | 20,600 |
| | Total | | | | | 663,100 |

STATEMENT OF FOREGOING ESTIMATE

| | |
|---|---|
| 136,750 yards of rock excavation, at $2 yer yard | $273,500.00 |
| 10,121 yards of bowlder excavation, at $1.65 per yard | 16,700.00 |
| 90,200 yards of loose rock and gravel, at 75 cents per yard | 14,400.00 |
| 26,800 linear feet of small dams, at $5 per foot | 134,000.00 |
| 28 locks and dams | 663,100.00 |
| Total | 1,101,700.00 |

A lock-and-dam navigation of 5 feet from the mouth of Wilson to the Lead Mines, overcoming a fall of 507 feet in 62 miles, will cost—

| | |
|---|---|
| Locks and dams | $1,524,000.00 |
| 38,000 yards rock excavation, at $2 | 76,000.00 |
| Total | 1,600,000.00 |

SUMMARY

| | |
|---|---|
| Two-foot navigation | $115,000.00 |
| Three-foot navigation | 1,101,100.00 |
| Five-foot navigation | 1,600,000.00 |

The counties traversed by the river within the limits of this survey are Grayson, Carroll, and Wythe, in Virginia, and Alleghany in North Carolina. These, with Ashe, a portion of Watauga, and Surrey, North Carolina, are dependent upon the river for a commercial outlet.

Alleghany County produces wheat, corn, oats, rye, buckwheat, potatoes, tobacco, hay, wool, butter, sheep, hogs, cattle, horses, &c. The growth of tobacco is a new industry, and the product small as yet. There has been some improvement in the mode of farming and in the yield of products since the census of 1870. The Peach Bottom Copper Mine, located in this county, 8 miles from the Mouth of Wilson, 12 miles from Independence, and 3 miles south of the river, was worked before the late war, but is now idle. The

Elk Creek Iron Furnace is located 6 miles from Mouth of
2992 Wilson. The ore used is found in extensive deposits on both sides of the river in Alleghany County, North Carolina,

and Grayson County, Virginia, about 7 miles from Mouth of Wilson. Mine and furnace both idle. The Collins Iron Works, about 16 miles east of Mouth of Wilson, in this county, are now idle. There are deposits of iron, and indications of copper, asbestos, mica, and other minerals in various parts of this county, which only require capital and enterprise for their development.

The productions of Ashe County, North Carolina, are very similar to those of Alleghany. Ashe has a larger area of improved lands and more wealth; the quality of the soil is also better; hence the agricultural products are larger though the same in kind. Ore Knob is located in this county about 15 miles above the Mouth of Wilson, and 3 miles from the south fork of New River. This mine is extensively worked by a Baltimore company, Mr. James Clayton, the principal proprietor, managing it. Only the pure copper is shipped to market, and that over a very rough and mountainous road at great expense. By increased facilities for transportation, the sulphur and peroxide of iron, now worthless and waste products, could be utilized.

There is also another vein of copper at Elk Knob, about 35 miles southwest of the Mouth of Wilson, in Watauga County; this mine is said to be very rich in its copper deposits, and some work is about commencing there for the purpose of testing their extent.

Hilton Furnace is situated in the county of Grayson, 10 miles west of the Mouth of Wilson. Extensive deposits of iron ore are found on both sides of the State line, and said to be of the finest quality. Furnace not now in operation.

There are also valuable soapstone quarries in Ashe County. One quarry near Jefferson, about 20 miles southwest of Mouth of Wilson, furnishes the supply of soapstone for the furnaces at Ore Knob, of a very superior quality and as white as alabaster.

Surry County, North Carolina, differs but little in its agricultural products from the other counties named, only in tobacco and sweet potatoes, which are extensively raised here.
2993 Nothing was ascertained about the mineral productions of this county.

There are extensive manufacturing establishments at Elkins and Mount Airy. At the former place, cotton and woolen establishments; at the latter, cotton, woolen, and tobacco factories, and also a factory for making ax handles, &c., and another for boots and shoes. Mount Airy is about 50 miles east of Mouth of Wilson, and 20 miles south of New River at the nearest point. Elkins is about 45 miles southeast from Mouth of Wilson, and 25 miles south of New River. Dr. William Hampton has opened a valuable copper mine near the mouth of Little River, in Grayson County, Virginia, but as yet it is not worked. He has also a soapstone quarry near by.

Grayson, Carroll, and Wythe are reported to be better agricultural counties than those described above, and their mineral resorces are wonderful. Cripple Creek, in Wythe County, is lined with iron furnaces. Snow Hill Branch, in the same county, has on it, near the river, large quantities of iron, zinc, and lead ores. It is deemed unnecessary, however, to give any further description of the resources of these counties, for the subject is thoroughly treated, as heretofore stated, by Colonel Abert and Maj. N. H. Hutton, in their reports, Appendix W of Annual Report of the Chief of Engineers of the United States Army for 1875, and Appendix T of Annual Report of same officer for 1873, to which attention is respectfully called.

I am indebted to Col. A. M. Davis, of Independence, Grayson County, Virginia, for much valuable information with regard to the resources of the counties in North Carolina.

Much credit is due J. M. Wolbrect, transitman, M. Cooke, leveler, and J. D. Hoffman, draughtsman, for the efficient performance of their respective duties.

Respectfully submitted.

WM. PROCTOR SMITH,
*Civil Engineer.*

Col. WILLIAM P. CRAIGHILL,
*Major Engineer Corps, U. S. A.*

2994 *Government exhibit 36*

REPORT OF THE CHIEF OF ENGINEERS, YEAR 1880

(pp. 107–108; 676–681)

19. New River, from the mouth of Wilson, in Grayson County, Virginia, to mouth of Greenbrier River, in West Virginia.—This improvement was commenced in the summer of 1877 on the section of the river just above New River Bridge, in Pulaski County, Virginia, the crossing of the Virginia and Tennessee Railroad, and continued in the low-water season of 1878. It is for the benefit of the bateaux now in use and for very light steamboats, and consists in giving a depth of channel of about 2 feet at low-water, the width to vary from 30 to 50 feet according to location and direction. This plan involves the blasting under water and removal of ledges and loose rock, placing the debris in wing-dams and training walls, excavating through gravel shoals and placing the material in the hearts of the dams, and thus making sluices and chutes, affording a good waterway without too much increasing the velocity and volume of the water in them. The operations on this section covered about 13½ miles.

In September 1878, for special reasons, the working force was transferred to the section of the river near Hinton. The character of the work has been the same. The space worked over has been about 15 miles. A small steamer has been put on this section.

Before the improvement was begun navigation was suspended during low-water. It can be continued now at any season on the improved portions.

In the last river and harbor act, Congress specially appropriated, for the first time, for the portion of the river above the Lead Mines in Wythe County, Virginia, thus extending the area of operations.

The total amount expended up to June 30, 1880, has been $41,916.74, with the results as stated above.

The last appropriation of $24,000, of June 14, 1880, will be expended according to the plan already indicated: $12,000 on
2995 the Greenbrier or lower section, over about 8 miles of new work, and in perfecting some of the old, about 20 miles in all; $7,000 on the middle or New River bridge section, as high up, it is hoped, as Mac's Creek, about 19 miles from the bridge; $5,000 on the upper section, where the work will be entirely new and its limits cannot be accurately defined at present.

The appropriation of $24,000, asked for the year ending June 30, 1882, it is proposed to apply in the same proportions to the several sections of the river as this year.

| | |
|---|---|
| July 1, 1879, amount available | $16,304.48 |
| Amount appropriated by act approved June 14, 1880 | 24,000.00 |
| | $40,304.48 |
| July 1, 1880, amount expended during fiscal year | 16,221.22 |
| July 1, 1880, amount available | 24,083.26 |
| Amount (estimated) required for completion of existing project | 205,000.00 |
| Amount that can be profitably expended in fiscal year ending June 30, 1882 | 24,000.00 |

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## G 19

### Improvement of New River From the Mouth of Wilson, in Grayson County, Virginia, to Mouth of Greenbrier River, in West Virginia

The full title of the last appropriation for this river is the following:

Improving New River from mouth of Wilson, in Grayson County, Virginia, to mouth of Greenbrier River, $24,000, of which

sum $12,000 shall be expended in the continuation of the work from the mouth of Greenbrier up, $7,000 in the continuation of the work formerly prosecuted on the river in Wythe County, and $5,000 between the lead mines, in Wythe County, and the mouth of Wilson, in Grayson County.

The appropriation is divided into three parts. The general plan of improvement adopted has been for the keel-boats now in use on the river, viz, to give a depth of channel of about 2 feet at low-water, the width to vary from 30 to 50 feet, according to location and direction. This plan involves the blasting under water and removal of ledges and bowlders, placing the debris in wing-dams and training walls, excavating through gravel shoals and placing the material in the hearts of the dams,
and thus making sluices and chutes affording a good water-
2996 way without too much increasing the velocity and volume of the water in them. All this work has been so irregular in character as to lead to the rejection of the contract method of doing it, and to the adoption of the method of procuring materials and labor by open purchase and hire as needed.

The first appropriation for this river was made August 14, 1876, and was for $15,000. Subsequent grants, including that of June 14, 1880, $24,000, have amounted to $66,000. The first work undertaken was in the summer of 1877, under the immediate supervision of Capt. James W. Cuyler, Corps of Engineers, on the section of the river above the crossing of the Virginia and Tennessee Railroad, in Pulaski County, Virginia. The working season on this river is necessarily short, being limited to that of low-water and warm water, as most of the work is best done by men standing in the water. Captain Cuyler's operations were successfully prosecuted in the summer and early autumn of 1877, resumed in 1878, and continued until the severe freshet of September, 1878, which caused a considerable loss of property and some damage to the unfinished portions of the work. The details of Captain Cuyler's work are fully stated in his reports in the Annual Reports of the Chief of Engineers for 1878 and 1879.

In August, 1878, it was decided to commence work at once on the section of the river immediately above the mouth of Greenbrier, at Hinton, in West Virginia, as the indications of immediate usefulness of the improved river in that section seemed greater than in the section worked over by Captain Cuyler. The operations near Hinton were placed under the supervision of Mr. A. M. Scott, and vigorously continued until near the end of

November, 1878. The work was resumed in June, 1879, under Col. William Proctor Smith. The reports of Mr. Scott and Colonel Smith in the annual report for 1879, and hereto appended, give the detailed history of the progress made up to June 30, 1880. A steamboat has been built at Hinton and runs on the river, taking advantage of the improvement as high as it has been carried above that point, about 15 miles. The bateaux have much greater ease in navigation and can carry larger loads. Other incidental advantages are mentioned by Colonel Smith in his report.

2997 If the appropriation of 1880 had been available earlier, advantage could have been taken for operations in the whole working season. As much will be done as can be. Operations will be resumed at once on the Greenbrier section, and to expend the portion of the money thereto allotted in the law, in making needed improvements in the channel already commenced and in use between Hinton and War Ford Shoals, a space of 11¾ miles; in finishing War Ford Shoals; in improving that portion of the river from War Ford Shoals to the mouth of Lick Creek, about 8 miles of new work. The last work is subdivided into eleven parts at different points.

Nearly two years having elapsed since the cessation of work on the section above New River Bridge, in Pulaski County, it will be necessary, although it is reported as in good condition, to make a careful examination there before it can be determined what should be undertaken. No unnecessary delay will be had in entering upon the work in this section as well as upon the section from the lead mines, in Wythe County, to the mouth of Wilson, in Grayson County. Of this last part a survey was made by Col. William Proctor Smith in 1878. A report thereof may be found in the Annual Report of the Chief of Engineers for 1879, page 538, Appendix F. No work has been done upon that portion of the river, but what is appropriate is supposed to be the same as has been in progress on the other parts. The estimate for a 2 feet navigation for bateaux, was $115,000; for a 3 feet steamboat navigation, $1,200,000; and for a 5 feet steamboat navigation, $1,600,000.

The combined estimates for the completion of the improvement of the three sections of the river for navigation by bateaux and small steamboats amount to $205,000. The same amount is asked for appropriation at the next session of Congress as was just granted, viz, $24,000, to be divided along the river as in the law of June 14, 1880.

MONEY STATEMENT

| | |
|---|---|
| July 1, 1879, amount available | $16,304.48 |
| Amount appropriated by act approved June 14, 1880 | 24,000.00 |
| | $40,304.48 |
| July 1, 1880, amount expended during fiscal year | 16,221.22 |
| July 1, 1880, amount available | 24,083.26 |
| Amount (estimated) required for completion of existing project | 205,000.00 |
| Amount that can be profitably expended in fiscal year ending June 30, 1882 | 24,000.00 |

2998 REPORT OF MR. WILLIAM PROCTOR SMITH, ASSISTANT ENGINEER

BALTIMORE, MD., *March 30, 1880.*

COLONEL: According to instructions received from you May 1, 1879, I examined the notes, maps, and reports of the New River improvement, in your office, in order to familiarize myself with my new duties.

On the 12th of May I went to Hinton, W. Va., and next day to Charleston, W. Va., to confer with Mr. A. M. Scott, assistant engineer in charge; returned on the 15th and formally took charge on the 20th, at which time Mr. Scott transferred the property.

From that time until the 3d of June, preparations were made for the season's operations, and a small force was set at work building walls in Greenbrier Shoals; not until the 16th, however, could any blasting be done, as the river was too high and muddy.

A full account of operations from the time I took charge to July 1, will be found in my reports for May and June.

From July 1 to November 8, 1879, the work was prosecuted with vigor, with a loss of only thirteen days out of a possible 113, and four of these were lost on account of delay in making the appropriation for 1879 available. The season was exceptionally good, so much so that I was not able to change one of the gravel-boats into a craneboat, which you authorized, as I wished the laborers employed on the work to make the change in bad weather, and thus keep them occupied.

The river remained nearly all of the time below the zero established last season and regarded as ordinary summer low-water, corresponding to a reading of 1.6 feet on the Hinton gauge. At one time the water was 7 inches below the point referred to. No one living on the river had ever seen it so low.

On the 8th of November 1879, I struck camp and moved to Hinton, and on the 30th finished all of the surveys.

The number of men employed averaged about eighty, and were divided into three parties; this was rendered necessary, as the

work was much scattered, at one time as much as 7 miles between
extremes. These parties were in camp, the men boarding
2999 themselves. I have two camps, one at the mouth of Blue
Stone River, 4½ miles above Hinton, and the other at the
upper end of War Ford, 12¼ miles above the same place.

There was no difficulty in getting laborers and wages were low, viz, $1 per day of ten hours, until the 15th September, at which time wages were increased to $1.25, and maintained so until the 1st of November, when $1.50 per day had to be paid for ten men five or six days, as the water was exceedingly cold. This was necessary, as it was desirable to get a channel, even though narrow, through War Ford Shoals.

The same dimensions of channel were adopted as used last season, 50 feet wide and 2 feet deep at ordinary low-water, which for this season would give about 18 inches at extreme low-water, and from 20 to 22 inches during an ordinary summer. In many places where there was a bend in the channel it was given a width of from 75 to 100 feet.

The material excavated was soft and had sandstone, loose rock, gravel, and large bowlders. The obstructions to navigation consist of a series of shoals from 100 feet to two-thirds of a mile in length, and the greater part of these composed of a series of ledges of solid rock, through which the channel had to be cut. So far as the work has progressed, comparatively small amounts of gravel and loose rock have been found, and no sand.

When it was practicable, the channel was located in the bateau "chutes" to save expense. In a number of instances, however, this would not answer and a straight line was adopted. In several cases the channel is crooked, as for instance, at the head of Greenbrier Shoals and the foot of Gartin's Ledges. To straighten these would have cost so much as to prevent much needed improvements beyond.

Upon the assurance of the owners of the steamboat that they could, and as they actually did, navigate these places, and at their urgent request, the work was carried on farther up the stream. The desire of the steamboat owners to get their boat through War Ford Shoals to Crump's Bottom, caused several points to be left in an unfinished condition, viz: Greenbrier Shoals, in which two walls should be built to check cross currents, the lower "chute" somewhat widened, and a small portion
of the lower ledge taken off. Some rock should be re-
3000 moved from the upper end of Deer Lick Ledges, and
possibly some gravel removed at the foot of Landcraft's Shoals, as well as a slight wall at Tom's Run Ledges, and points of some of the ledges should be softened down between Hinton's Landing and the mouth of Greenbrier River.

The improvement, as now made, enables the steamboat to go up 12½ miles at ordinary low-water, and with a rise of 7 inches she can go, and has gone, up above Crockett's Store, 15 miles from Hinton.

The work is of great benefit to bateaux, enabling them to get through with a great deal of ease and to carry much larger cargoes than formerly, and, in fact, they can run now where it was utterly impossible before, owing to low water. Of these lines there are three, one to Bluestone, 5 miles, one to Crockett's Store, 14½ miles, and one to Lick Creek, 20 miles above Hinton.

It is also an advantage to the lumber business, as rafts can get through easily, and many hundred thousand feet have been taken down the stream this season from the region of the Bluestone.

The country is beautiful, with the usual river hills, the tops and sides of which are cultivated to a considerable extent, with here and there fertile bottoms. At the head of the improvement this season begins Crump's Bottom, which is 5 miles long and exceedingly rich.

Notwithstanding the heavy grade a large number of wagons, laden with agricultural products of a rich portion of Mercer County, daily uses a road which crosses the river by ferry just above Bull's Falls, and leads thence down the stream to the Chesapeake and Ohio Railroad at Hinton.

Going up farther, to the mouth of Indian Creek, another road is met, which leads, with a fine grade, to the Red Sulphur Springs and beyond, and as this celebrated watering place is only 6 miles distant, it would be a pleasant trip for persons wishing to visit it to take boat at Hinton, pass delightfully the few hours occupied in making the 16 miles in relaxtion from railroad travel and in viewing the beautiful scenery. Arriving at the point referred to, coaches could carry them to their destination.

The best road in the country, however, comes to and crosses the stream at the mouth of Lick Creek, 20 miles above
3001 Hinton. By this route nearly all of the marketable stuffs from the rich counties, Tazewell, Mercer, and Monroe, seek an outlet. Taking this into consideration, it is regarded as very desirable to push the improvement to that point next season, if possible.

With regard to the boat, it now, at low-water, makes trips three times a week to Bull's Fall, and, when there is a slight rise, extends them to Crockett's Store.

The machinery is somewhat too light for the dimensions of the boat, and it is in contemplation to either reduce its size and use the same machinery, or else let it remain as it is and increase the power.

There is no doubt about the steam navigation on this river being a success, for there is plenty of water, as the following observations for quantity, a few hundred feet above Bull's Fall will show, and all that is necessary is for it to be concentrated into one channel.

The quantity of water at the point referred to is 2,100 cubic feet per second at the extremest low-water, quite sufficient for any system of improvement.

Further, with regard to the resources of this country, it may be well to state that for miles south of and including Peter's Mountain, at the "Narrows" along the river, there is a large amount of brown and red hematite and specular iron ore.

A narrow-gauge railroad is now being constructed along the banks of the stream, and as it will cross at some point, as yet undetermined, the question of a draw in the bridge, or of a grade sufficient to allow the boat to pass under, will have to be looked into.

As giant powder or dynamite had been thoroughly tested the previous season, its use was continued with good effect. After the rock was blasted the stone was placed by hand on "jolly-boats" and carried to the walls, which were built with sufficient strength and height, but without regard to slopes. Wing-dams were built in a similar manner.

Ring-bolts, to which lines are attached to "wind" through the difficult "chutes," have been placed at frequent intervals.

From the tables, which give in detail much information
3002 with regard to the work, it will be seen that Bull's Fall has a grade of 1 foot in 100 feet, and a current of 7 miles per hour, and yet the boat "winds" through without difficulty. Owing to the strong current it was very difficult to make the shelter-dams stand in these falls. The work, however, was prosecuted with energy in good weather and without accident. The successful means employed in making this channel will be of great benefit when similar falls, found above, are to be improved.

War Ford Shoal is 2,200 feet long, with a fall of 1 foot in the upper 1,000 feet, and 5.4 feet in the lower 1,200 feet. In the latter, which has a current of 4 miles per hour, it is thought that a wire cable may be used with advantage for "winding." The width of channel in the upper portion, as left this season, is only 30 feet; this will have to be given the proper width as early as possible. The velocity of the water in this section is about 2 miles per hour.

Through the main "chutes" at Garten's Ledges, Bluestone Shoals, and lower Greenbrier Shoals, the current is strong and grade heavy, but the boat has not experienced any difficulty in getting through.

To finish the work as now projected, from Hinton to the upper end of War Ford Shoals, will require $2,000.

From War Ford Shoals to the mouth of Lick Creek, 20 miles above Hinton, will require $11,000.

Beyond this point I have not sufficient data to make an estimate; it is not important, however, for the work cannot begin until a new appropriation is made, which will necessarily cause the working to be so short as to render it doubtful whether the improvement can be carried to Lick Creek, much less beyond.

In a good season it is thought that $25,000 can be advantageously expended on this improvement.

Detailed maps of the points worked at have been made on a scale of 100 feet to the inch, comprised in 9 sheets. Also one showing the readings of the water-gauge at Bluestone and War Ford during the working season.

A map of New River, from the steamboat landing at Hinton to the upper end of War Ford, 12¼ miles, showing the positions of the shoals and ledges, with appropriate references to maps in detail, on a scale of 800 feet to the inch, accompanies this report.

3003

The property belonging to the improvement is stored at Mr. M. Smith's, near Bull's Fall.

I am much indebted to Mr. T. Schoonmaker, superintendent, for valuable services rendered in construction, surveying, and mapping.

Respectfully submitted.

WM. PROCTOR SMITH,
*Assistant Engineer.*

Col. WM. P. CRAIGHILL,
*Major, Corps of Engineers, U. S. A.*

TABLE SHOWING THE DISTANCES FROM STEAMBOAT LANDING AT HINTON, W. VA., TO FOOT OF SHOALS AND LEDGES, THEIR LENGTH OR WIDTH, AND DIFFERENCES OF LEVELS BETWEEN THE HEAD AND FOOT OF SAME, 1879

| Shoal or ledge | Distance in miles | Length or width in feet | Fall in feet |
|---|---|---|---|
| Ledges between Hinton and Greenbrier Shoals | ¼ | 5,940 | 4.95 |
| Greenbrier Shoals | 1½ | 3,700 | 7.20 |
| Pack's Ferry Ledge | 3½ | 200 | 0.70 |
| Deer Lick Ledges | 4½ | 200 | 1.83 |
| Bluestone Shoals | 4⅞ | 380 | 2.47 |
| Landcraft's Ford Shoals | 5¼ | 2,950 | 2.20 |
| Landcraft's Shoals | 5⅞ | 1,900 | 4.05 |
| Buffalo Shoals | 7½ | 2,400 | 3.35 |
| Barker's Shoals | 8⅝ | 100 | 0.75 |
| Gartin's Ledge Shoals | 9 | 4,000 | 4.34 |
| Ellis's Shoals | 10¾ | 1,200 | 1.75 |
| Bull's Fall | 11½ | 300 | 2.70 |
| Tom's Run Ledges | 11¾ | 200 | 1.70 |
| War Ford Shoals | 11¾ | 2,200 | 6.40 |

The readings of the temporary water-gauges, and during the season, were noted at the time the above levels were taken, and all found to be below the zero or ordinary low-water mark, except Ellis's which was slightly above.

Elevation of the mouth of Greenbrier River above tide-water---- 1.352 feet
Elevation of the head of War Ford Shoals above tide-water---- 1.406 feet

3004 TABLE SHOWING THE QUANTITY AND QUALITY OF MATERIAL EXCAVATED IN MAKING CHANNEL, 1879

| Location | Solid rock | Loose rock | Gravel | Total |
|---|---|---|---|---|
| | *Cub. yds.* | *Cub. yds.* | *Cub. yds.* | *Cub. yds.* |
| Ledges between Hinton and Greenbrier Shoals | 327 | 40 | | 367 |
| Greenbrier Shoals | 743 | | | 743 |
| Pack's Ferry Ledges | 20 | 80 | | 100 |
| Rufus Pack's Bowlders | 16 | | | 16 |
| Deer Lick Ledges | 27 | | | 27 |
| Landcraft's Ford Shoals | 523 | 350 | 173 | 1,046 |
| Landcraft's Shoals | 1,914 | | 264 | 2,178 |
| Buffalo Shoals | 397 | 524 | 148 | 1,069 |
| Barker's Shoals | 85 | | | 85 |
| Gartin's Ledges Shoals | 577 | 222 | 371 | 1,170 |
| Ellis's Shoals | 5 | 474 | 28 | 507 |
| Bull's Fall | 775 | | | 775 |
| Tom's Run Ledges | 84 | | | 84 |
| War Ford Shoals | 3,071 | | | 3,071 |
| Total | 8,564 | 1,690 | 984 | 11,238 |

| | *Per cubic yard* |
|---|---|
| Total excavation, including all materials | $1.60 |
| Solid rock | 1.72 |
| Loose rock | 1.00 |
| Gravel rock | 1.60 |

The gravel is high, owing to its having to be removed by hand, with shovels, in very swift water.

The quantities were obtained by measuring the main and wing walls, composed of the material excavated.

TABLE SHOWING DETAILS OF BLASTING, 1879

| | | |
|---|---|---|
| Number of holes drilled | | 6,843 |
| Number of feet of holes drilled | feet | 12,023 |
| Average depth of holes | do | 1.73 |
| Average depth of holes (1½ inches) drilled per day per drill | do | 13.35 |
| Number of blasts fired | | 7,003 |
| Number of blasts missed | | 160 |
| Average charge of powder in each cartridge | pounds | 0.383 |
| Average loosening of rock for blast | yards | 1¼ |

TABLE SHOWING SHIPMENTS FROM NEW RIVER, AT HINTON, W. VA., 1879

| | | |
|---|---|---|
| Tobacco | pounds | 670,550 |
| Wheat | do | 623,311 |
| Butter | do | 22,726 |
| Beans | do | 15,562 |
| Flaxseed | do | 6,821 |
| Wool | do | 7,889 |
| Feathers | do | 650 |
| Eggs | dozen | 8,559 |
| Lumber | feet | 1,393,400 |

3005 *Government exhibit 37*

REPORT OF THE CHIEF OF ENGINEERS, YEAR 1881

(pp. 144–145; 904–911)

21. New River, from the mouth of Wilson, in Grayson County, Virginia, to mouth of Greenbrier River, in West Virginia.—From the mouth of Wilson, in Grayson County, Virginia, to steamboat landing at Hinton, Summers County, West Virginia, 1½ miles below the mouth of Greenbrier River, is 191½ miles. The appropriations have been made in such a manner as to divide this portion of the river into three sections as follows:

| | Miles |
|---|---|
| Upper or Dead Mines | 62 |
| Middle or New River Bridge | 43 |
| Lower or Greenbrier | 86½ |

Throughout this distance, the navigable channel originally consisted of natural chutes, through the ledges and shoals, of varying widths, rarely over 1 foot in depth, in some places so tortuous as to render navigation extremely difficult and dangerous.

The original project adopted for the improvement of these natural channels was to widen them to 30 or 50 feet, as might be required, and deepen them to 2 feet, and straighten such as needed it. This was for keel-boat navigation, the improvement, however, to be made in such a manner as to aid the work, should a greater depth and width be required in the future.

A small steamboat, draught 12 inches, when light, having been built at Hinton, in the fall of 1878, rendered it necessary to make the channel, in that section, 50 feet wide at all points, and in many from 75 feet to 100 feet, the depth of 2 feet being retained.

June 30, 1880, there was a channel, 50 feet wide and 2 feet deep, from Hinton Landing to Hubbard's Ripple, a distance by river of 12¼ miles, giving an outlet to the products of Mercer County, West Virginia.

At the close of the season's work for 1880, there was a
3006 channel, of the same width and depth, from Hinton Landing to McDaniel's or Harvey's Falls, a distance of 17¾ miles, giving an outlet to the farmers and graziers of Crump's Bottom and the Indian Creek country. And, in addition to the above, 12 miles of improvement from New River Bridge to Peak's Creek, with a channel 30 feet wide and 2 feet deep, giving outlet for timber and farm products, but not available for iron or other ores, until Radford Furnace can be reached.

The appropriation for the fiscal year ending June 30, 1882, will carry the improvement on the Greenbrier division through Wiley's Falls, 26 miles above Hinton, passing the mouth of Lick Creek, 20

miles above Hinton, thus opening up the trade from Tazewell and other rich counties adjoining.

The appropriation for the fiscal year ending June 30, 1882, will carry the improvement on the New River Bridge division to Carter's Ferry, 33 miles above the bridge, and give an outlet to the iron from Radford Furnace, 18 miles above the bridge, to the ores from an iron mine 8 miles beyond, to Graham's new furnace and iron-works, the former 31 miles, and latter 33 miles above the bridge, as well as to two zinc mines in the same section.

The appropriation for the fiscal year ending June 30, 1881, will carry the improvement on the Lead Mines division to the "Gulf," 8 miles above the mines, giving outlet to charcoal and timber.

No appropriation for the fiscal year ending June 30, 1882.

With a channel, as now proposed, 20 feet wide and 2 feet deep, the estimate of $181,000 would be sufficient to complete it, but as that portion from Hinton to New River Bridge has to be made 50 feet wide, at a cost of about $2,000 per mile, the above amount should be increased to $275,000, and if it becomes absolutely necessary to use locks and dams for the improvement of some of the falls, this estimate will have to be further increased by the amount of their cost.

On the lower division there are 8 keel-boats, 6 tons each, 18 inches draught, loaded; one small stern-wheel steamboat, 30 tons, 18 inches draught, loaded, and another being built.

3007 On the middle division two keel-boats, of the same tonnage and draught as above, are in use carrying ores, and six more building.

On the upper division only canoes are in use. Many rafts on each of these divisions, but their number was not ascertained.

| | |
|---|---|
| July 1, 1880, amount available | $24,083.26 |
| Amount appropriated by act approved March 3, 1881 | $24,000.00 |
| | $48,083.26 |
| July 1, 1881, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1880 | 16,179.09 |
| July 1, 1881, amount available | 31,904.17 |
| Amount (estimated) required for completion of existing project | 181,000.00 |
| Amount that can be profitably expended in fiscal year ending June 30, 1883 | 25,000.00 |

## G 21

### Improvement of New River From the Mouth of Wilson, in Grayson County, Virginia, to the Mouth of the Greenbrier River in West Virginia

The operations of 1880 subsequent to June 30 appear in detail from the following report of Col. W. P. Smith, Assistant Engineer, dated April 8, 1881:

BALTIMORE, MARYLAND, *April 8, 1881.*

COLONEL: I have the honor to submit the following report of operations on New River, Virginia and West Virginia, for the season of 1880.

A project for the expenditure of $12,000 appropriated for this work, from the mouth of the Greenbrier up, for the fiscal year ending June 30, 1881, was submitted to and approved by you early in July.

On the 26th I went to Hinton, W. Va., and commenced the work on the 2d of August, with a force of about 40 men, divided into two parties, under competent foremen. Later in the season another force was organized, composed of from 12 to 15 men, to make necessary improvements in the channel already made. The interval, from 26th July to 2d August, was used in getting ready for the work.

From August 2 to October 31 the work was carried on with good results; after that a party of 15 men was employed in trimming up the walls and getting out loose stone.

The latter part of the season being cool, the men dropped
3008 off considerably, reducing the general average for the whole time to fifty.

Out of eighty-nine working days only eight were lost; the gauge standing at or near zero, ordinary low-water never reading more than 1 foot above, nor 0.5 foot below.

The improvement of the former work consisted in building two walls in Greenbrier Shoals to check cross-currents and placing a ring-bolt at the head of the lower one; gravel taken out of the lower part of Land Craft's Shoal; stone removed from Garten's Ledges and Ellis Shoals; wall renovated at Bull's Fall; stone taken out, and channel widened at Tom's Run; width of channel increased from 30 feet to 50 feet in the upper 1,000 feet of War Ford Shoals, and on the south side a natural channel behind an island, 600 feet long, improved by blasting the rock at the upper and lower ends, and cutting off intermediate points; the steamboat now owned by an agent of the Standard Oil Company, which company is getting out a large number of staves in this section, will use this channel in high-water going up stream, the long "chute" to be used at all times for low-water.

This part of the work covers a river space of 12⅛ miles with a fall over the ledges and shoals of 44.09 feet, and with a combined length of shoals and ledges equal to 25,670 feet. This work is shown on the maps prepared the previous seasons.

The new work for 1880 consisted in opening a channel through Hubbard's and Sweeny's Ripples, three in all; Crockett's and Sweeney's Ledges, six in all; removing gravel from Indian Creek Shoals, also some loose rock, but not enough to classify, and

Crump's Ledges, five in number, composed of sound rock exceedingly hard, with iron pyrites running through it, rendering the drilling very difficult and expensive, making the average price for the season 20 cents more per cubic yard than last; the gravel, however, in Indian Creek Shoals was handled at small cost, reducing the average price to one-half what it was last season. One of the walls in Crump's Ledges will have to be extended to prevent washing of the banks; the weather got too cold to attend to it last fall.

3009. This work covers a river space of 5½ miles, with a fall of 10.54 feet over ledges and shoals and 6,460 feet of cutting through them, the shoals varying in length from 100 feet to 1,900 feet, the heaviest grade being less than 0.4 foot per 100 feet, levels taken with gauge reading at 0.5 foot above zero. For width or length, fall, distance from Hinton, and material taken out of shoals and ledges, reference is made to the tables.

The river is now open from Hinton Landing to McDaniell's or Harvey's Falls, a distance of 17¾ miles, with a channel 50 feet wide and 2 feet deep at ordinary and 18 inches at extreme low-water.

The actual amount of cutting through these ledges and shoals, in the entire distance, amounts to 6$\frac{1}{12}$ miles, with a fall over the same of 54.81 feet, levels taken with gauge reading nearly at zero; total fall 62 feet, averaging 3½ feet per mile.

Four thousand nine hundred and ten linear feet of new wall, averaging 8 feet wide and 3 feet high, were built, and 715 cubic yards of material put in old walls. Cost of solid rock $1.92 and gravel 71 cents per cubic yard.

Two and a half miles will carry the improvement to the mouth of Lick Creek, 20 miles above Hinton, a point which it is very desirable to reach to get freight from the rich counties adjoining, as fully set forth in Mr. A. M. Scott's report, May 26, 1879, and in mine March 30, 1880, forming a part of your annual report to the Chief of Engineers, United States Army, for 1880.

In this distance about $4,000 will have to be expended to get a channel through two falls, two ledges, and one shoal.

I would respectfully suggest that a careful survey of Neilly's or Shumate's falls and rapids, about 30 miles above Hinton, be made, with reference to a lock and dam at that point; they may possibly be improved by cutting a sluice along the left bank, but the survey should be made to ascertain its feasibility. Whole fall, 11 feet; 6 feet of this nearly vertical.

3010 Four lines of keel boats, eight in all, now run regularly on this part of the river, the improvement enabling them to carry two-thirds more freight than formerly; for instance, 1,500 feet of lumber used to be a load; now it is 4,500 feet.

The latter part of June you notified me that I was to assume control of the improvement of this river between New River Bridge, in Pulaski County, Virginia, and the lead mines in Wythe County, Virginia, for the continuation of which $7,000 had been appropriated, as well as the expenditure of $5,000 from the lead mines to the mouth of Wilson, in Grayson County, Va.

Accordingly, about the middle of August, as soon as the work from the mouth of Greenbrier up was well under way, I went to New River Bridge and examined the river to the mouth of Reed Island Creek, 26½ miles, with a view of getting data for making a project for the expenditure of the money appropriated for this section. That accomplished, I went to the lead mines and examined the river south to the foot of what is called the "Gulf," in Carroll County, Virginia, nearly 8 miles from the mines; then returned to Hinton and submitted project, as directed, for the improvements in these localities; was notified of the approval of the same September 15, and on 18th started for New River Bridge; got to work building boats and canoes 23d, and on October 4 commenced clearing out the channels made by Captain Cuyler, United States Engineers, during the seasons of 1877 and 1878, which had been injured to a considerable extent by the severe flood of September 14, 1878.

The principal part of this work, which extends from the bridge to Peake's Creek, 12 miles, was at Buck's Falls, where the supporting walls had been washed away and channel filled up; this channel is 30 feet wide and 2 feet deep for bateaux, with walls so arranged that it can be widened and deepened for steam navigation when desired.

The weather becoming cold the work was suspended on 1st November. The force having to be moved every few days, in three small boats, caused loss of time, and consequently increased the price of getting out the limestone rock to $2.10 and gravel to 95 cents per cubic yard.

Four hundred and thirty-eight linear feet of new wall
3011 was built, averaging 7 feet wide and 3 feet high, and 73 cubic yards of material put in old walls.

This work is shown on detail maps in your office, made by Captain Cuyler, United States Engineers.

The owner of Radford Iron Furnace, 18 miles above New River Bridge, as well as those of a furnace on Little Reed Island Creek, 26½ miles from the bridge, are anxious to send iron and ores down by bateaux; and, in addition, the following may be expected to ship: Forge at mouth of Little Reed Island Creek; Barren Spring Furnace; furnace near this belonging to Graham and Robinson; Bertha Zinc Works; Falling Cliff Zinc Works, to be started soon, and yet another, by a New York company, near the Bertha mine.

As only bateaux will navigate this stream for the present, the project submitted and approved calls for a channel 2 feet deep and 20 feet wide, which will allow rafts to pass as well as boats.

For further description of this improvement, reference is made to the following reports of Capt. J. W. Cuyler, Engineer Corps, United States Army, July 1, 1878, March 15, and July 3, 1879, forming a part of your annual report, for the same years, to the Chief of Engineers, United States Army.

These reports are referred to especially, as no new work was done this season, and all of the river gone over is minutely described therein.

From the lead mines up, it is proposed to make a channel as below, 2 feet deep and 20 feet wide, a width sufficient for bringing charcoal for the furnaces down in bateaux, and for rafts of timber, of which there is an abundance in this region; there are also large deposits of copper in Carroll County, which it is thought will be eventually mined and shipped over this route.

For 5 miles above the lead mines the obstructions in the river are about the same as described elsewhere; then the fall becomes very abrupt, as the mountains are here reached; these extend for 14 miles, which will necessarily make the work heavy for that distance.

For description of this section reference is made to my
3012 report of a survey made of this part of the river, dated January 10, 1879, contained in your annual report to the Chief of Engineers, United States Army, for the same year.

Owing to the lateness of the season, no work was done on this division.

As Foster's Falls, 37 miles above New River Bridge, offers such an obstruction to navigation as to prevent the lead mines and furnaces above from shipping their products down the river, it is respectfully recommended that a careful survey be made of them with a view to their improvement by locks and dams; "the fall is about 18 feet, over slate and limestone ledges, in 2,300 feet, with a short pool and a succession of ledges."

During the winter, the country in the vicinity of New River Bridge and the lead mines was explored in search of suitable timber for crane and other boats to be used on the works the coming season.

Much of the timber has been secured and boats are now being built.

Maps on a scale of 1 inch to 100 feet, comprised in four sheets, have been made, showing the details of the work on the Greenbrier division; also one exhibiting the readings of the water-gauge at War Ford.

Two maps showing portions of the river improved on a scale of 800 feet to an inch, one from War Ford to Harvey's Falls, 5⅔ miles; the other from New River Bridge to Peak's Creek, 12 miles, with appropriate references to detail sheets, accompany this report.

Tables explanatory of the work in detail, as well as others giving shipments from New River at Hinton Station, on the Chesapeake and Ohio Railway, and nine stations on the Atlantic, Mississippi, and Ohio Railway, are appended.

I am indebted to Charles F. Littlepage and Reuben Hurley for valuable assistance in the execution of this work, the former on the Greenbrier division, the latter at New River Bridge and the lead mines; their judgment and good management are to be commended.

3013 SUMMARY

From the mouth of Wilson, in Grayson County, Virginia, to steamboat landing at Hinton, Summers County, West Virginia, 1½ miles below the mouth of Greenbrier River, 191½ miles. The appropriations have been made in such a manner as to divide this portion of the river into three sections, as follows:

| | Miles |
|---|---|
| Upper, or Lead Mines | 62 |
| Middle, or New River Bridge | 43 |
| Lower, or Greenbrier | 86½ |

Throughout this distance the navigable channel originally consisted of natural chutes through the ledges and shoals, of varying widths, rarely over 1 foot in depth, in some places so tortuous as to render navigation extremely difficult and dangerous.

The original project adopted for the improvement of these natural channels was to widen them to 30 or 50 feet, as might be required, and deepen them to 2 feet, and straighten such as needed it.

This was for keel-boat navigation; the improvement, however, to be made in such a manner as to aid the work, should a greater depth and width be required in the future.

A small steamboat, when light, draught 12 inches, having been built at Hinton, in the fall of 1878, rendered it necessary to make the channel in that section 50 feet wide at all points, and in many from 75 feet to 100 feet, the depth of 2 feet being retained.

June 30, 1880, there was a channel 50 feet wide and 2 feet deep from Hinton Landing to Hubbard's Ripple, a distance by river of 12½ miles, giving an outlet to the products of Mercer County, West Virginia.

At the close of the season's work for 1880, there was a channel of the same width and depth, from Hinton Landing to McDaniell's or Harvey's Falls, a distance of 17¾ miles, giving an outlet to the farmers and graziers of Crump's Bottom and the Indian Creek country. And in addition to the above there are 12 miles of improvement from New River Bridge to Peak's Creek, with a channel 30 feet wide and 2 feet deep, giving outlet for timber and farm products, but not available for iron ores until Radford Furnace can be reached.

The appropriation for the fiscal year ending June 30, 1882, will carry the improvement on the Greenbrier division through Wiley's Falls, 26 miles above Hinton, passing the mouth of Lick Creek, 20 miles above Hinton, thus opening up the trade from Tazewell and other rich counties adjoining.

The project as far as Lick Creek has been approved.

The appropriation for the fiscal year ending June 30, 1882, will carry the improvement on the New River Bridge division to Carter's Ferry, 33 miles above the bridge, and give an outlet to the iron from Radford Furnace, 18 miles above the bridge, to the ores from an iron mine 8 miles beyond, to Graham's new furnace and iron works, the former 31 miles and the latter 33 miles above the bridge, as well as to two zinc mines in the same section. The project as far as Jones's Ford Shoals, 20½ miles above New River Bridge, has been approved.

The appropriation for the fiscal year ending June 30, 1881, will carry the improvement on the Lead Mines division to the "Gulf," 8 miles above the mines, giving outlet to charcoal and timber. This project has already been approved. No appropriation for the fiscal year ending June 30, 1882.

With a channel, as now proposed, 20 feet wide and 2 feet deep, the estimate of $205,000 would be sufficient to complete it; but as that portion from Hinton to New River Bridge has to be made 50 feet wide, at a cost of about $2,000 per mile, the above amount should be increased to $275,000, and if it becomes absolutely necessary to use locks and dams for the improvement of some of the falls this estimate will have to be further increased by the amount of their cost.

The tables give a clear exhibit of the products shipped from the valley of New River at the various railroad stations in 1880, and also the tonnage received for the same section.

On the lower division there are eight keel-boats, 6 tons each, 18 inches draught, loaded. One small stern-wheel steamboat, 30 tons, 18 inches draught, loaded, and another being built.

On the middle division two keel-boats, of the same tonnage and draught as above, are in use carrying ores, and 6 more building.

On the upper division only canoes are in use. Many rafts are on each of these divisions, but their number was not ascertained.

Respectfully submitted.

WM. PROCTOR SMITH,
*Assistant Engineer.*

Lieut. Col. WM. P. CRAIGHILL,
*United States Engineer.*

3013-A TABLE SHOWING THE DISTANCES FROM STEAMBOAT LANDING AT HINTON, W. VA., TO FOOT OF SHOALS OR LEDGES, THEIR LENGTH OR WIDTH, AND DIFFERENCE OF LEVEL BETWEEN THE HEAD AND FOOT OF SAME; ALSO, THE QUANTITY AND QUALITY OF MATERIAL EXCAVATED IN MAKING AND IMPROVING THE CHANNEL IN 1880

| Shoal or ledge | Distance | Length or width | Fall | Solid rock | Gravel | Total |
|---|---|---|---|---|---|---|
| | *Miles* | *Feet* | *Feet* | *Cub. yds.* | *Cub. yds.* | *Cub. yds.* |
| Ledges and shoals from Hinton to and including War Ford | 12¼ | 25,670 | 44.09 | 528 | 296 | 824 |
| Hubbard's Ripple | 12⅝ | 100 | 0.20 | 88 | 44 | 132 |
| Sweeny's Ledges | 12¾ | 1,860 | 2.47 | 509 | | 509 |
| Sweeny's Ripples | 13⅛ | 1,150 | 0.93 | 70 | 70 | 140 |
| Crockett's Ledges | 14⅛ | 500 | 1.92 | 373 | | 373 |
| Indian Creek Shoals | 15¾ | 1,350 | 3.06 | | 908 | 908 |
| Crump's Ledges | 15⅞ | 1,500 | 2.14 | 2,075 | | 2,075 |
| Total | | 32,130 | 54.81 | 3,743 | 1,318 | 5,061 |

TABLE SHOWING THE SAME AS ABOVE FOR FALLS, SHOALS, AND RIPPLES, WORKED AT DURING THE SEASON OF 1880, ON THE MIDDLE DIVISION, NEW RIVER BRIDGE BEING THE INITIAL POINT.

| Falls, shoals, and ripples | Distance | Length or width | Fall | Solid rock | Gravel | Total |
|---|---|---|---|---|---|---|
| | *Miles* | *Feet* | *Feet* | *Cub. yds.* | *Cub. yds.* | *Cub. yds.* |
| Ripple No. 1 | ⅛ | 110 | [1] 0.54 | 50 | | 50 |
| Ripple No. 2 | ⅛ | 20 | [1] 0.50 | 2 | | 2 |
| Ingle's Falls | 2¾ | 2,640 | [1] 5.11 | | 14 | 14 |
| Moore's Gravel | 6¾ | 2,200 | [1] 2.79 | | 5 | 5 |
| Buck's Falls | 7⅛ | 400 | [1] 1.00 | 91 | 333 | 424 |
| Egypt Falls | 8⅛ | 700 | [1] 0.98 | 6 | | 6 |
| Peak's Creek, shoals and ledges | 10⅛ | 6,661 | 13.48 | 10 | | 10 |
| Total | | 12,731 | 25.40 | 159 | 352 | 511 |

[1] Levels need verifying.

TABLE SHOWING THE DETAILS OF BLASTING FROM HINTON, WEST VA., UP THE RIVER, 1880

| | | |
|---|---|---|
| Number of holes drilled | | 2,982 |
| Number of feet of drilling | | 4,984 |
| Number of blasts fired | | 3,066 |
| Number of blasts missed | | 24 |
| Number of blasts fired under bowlders | | 110 |
| Average depth of holes | feet | 1.70 |
| Average depth of holes drilled per day per drill | do | 11.50 |
| Average charge of powder | pounds | 0.38 |
| Average loosening of rock per blast | cubic yards | 1.22 |

3014 TABLE SHOWING THE DETAILS OF BLASTING, FROM NEW RIVER BRIDGE, SOUTH, 1880

| | | |
|---|---|---|
| Number of holes drilled | | 138 |
| Number of feet of drilling | | 230 |
| Number of misses | | 2 |
| Average depth of holes | feet | 1.75 |

STATEMENT OF TONNAGE SENT FROM AND RECEIVED AT HINTON STATION, CHESAPEAKE AND OHIO RAILWAY, FOR THE FISCAL YEAR ENDING SEPTEMBER 30, 1880

(Furnished by R. P. Fisher, Auditor)

| Articles | Hinton | | New River | |
|---|---|---|---|---|
| | Sent | Received | From— | To— |
| Lumber | 14,194.24 | 70.52 | 2,180.00 | |
| Coal | 99.12 | 530.52 | | |
| Salt | 20.96 | 285.16 | | 6.10 |
| Bacon | 27.20 | 22.52 | 20.40 | 22.52 |
| Lard | 2.12 | 100.40 | 2.12 | 100.40 |
| Flour | 3.20 | 57.60 | | |
| Whisky | .80 | 5.28 | | |
| Merchandise | 136.32 | 838.56 | 55.40 | 644.20 |
| Wheat | 1,746.48 | | 1,251.28 | |
| Hay | 97.28 | 30.00 | 97.28 | 30.00 |
| Butter | 25.36 | | 25.36 | |
| Cattle | 41.52 | | 41.52 | |
| Eggs | 25.28 | | 25.28 | |
| Horses | 15.00 | | | |
| Sheep | 40.36 | | 40.36 | |
| Wool | 46.56 | | 46.56 | |
| Corn | 104.20 | | 104.20 | |
| Dried fruit | 27.76 | | 27.76 | |
| Rye | .28 | | .28 | |
| Flaxseed | 24.88 | | 24.88 | |
| Leaf tobacco | 401.80 | | 401.80 | |
| Oats | 2.68 | | 2.68 | |
| Sundries | 8,309.56 | 108.56 | 6,225.56 | 55.00 |
| Total | 25,392.96 | 2,049.12 | 10,572.72 | 858.22 |

This table shows that 41½ percent of the products shipped from and to Hinton is from the section of New River now being improved; 409 tons from New River were shipped at Lowell, a station on Greenbrier River, and 87 tons sent thereto.

3015 STATEMENT OF TONNAGE SENT FROM AND RECEIVED AT THE FOLLOWING STATIONS ON THE ATLANTIC, MISSISSIPPI AND OHIO RAILWAY FOR THE YEAR ENDING DECEMBER 31, 1880

(Furnished by E. E. Portlock, auditor)

| Name of stations | Sent | Received | General classification of tonnage sent | |
|---|---|---|---|---|
| | | | Products | Tons |
| | Tons | Tons | | |
| Christiansburg | 4,816.72 | 2,104.55 | Of animals | 8,098.57 |
| Central | 719.70 | 182.20 | Of agriculture | 4,143.79 |
| New River | 987.53 | 253.61 | Of the forest | 612.75 |
| Dublin | 3,927.31 | 1826.17 | Of manufactures | 265.06 |
| Martin's | 5,335.00 | 4,508.36 | Of the mines | 12,704.58 |
| Max Meadow | 4,109.22 | 1,382.40 | Of vegetables | 566.11 |
| Wytheville | 2,495.31 | 2,415.64 | Other articles | 358.68 |
| Crockett | 3,822.68 | 604.61 | Miscellaneous | 1,136.89 |
| Rural Retreat | 1,661.96 | 552.93 | | |
| Total | 27,885.43 | 13,330.37 | | 27,885.43 |

The above is all from the two upper sections of New River now being improved, and it may be safely asserted that not less than one-third of this amount will be shipped by water as soon as the channel is made.

Of the products of the mines, which amount to 7,044 tons, exclusive of coal, seven-eighths will be carried in boats down to New River Bridge Station.

The proportion of tonnage received, that will be sent over this route, could not be ascertained.

W. P. S.

Operations were suspended at the close of October 1880, and not resumed until May, 1881. As much of the work is done by men in the water, it can only be carried on when the water is low, is clear, and not too cold.

An appropriation of $24,000 was made March 3, 1881, for the application of which a project, given below, was submitted to the Chief of Engineers April 27, 1881, and by him soon after approved. Under this and previous projects the work has been actively continued to the end of the fiscal year, and will be as long as the state of the river allows in 1881, and will be resumed as early as possible in 1882.

3016 MONEY STATEMENT

| | |
|---|---|
| July 1, 1880, amount available | $24,083.26 |
| Amount appropriated by act approved March 3, 1881 | 24,000.00 |
| | $48,083.26 |
| July 1, 1881, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1880 | 16,179.09 |
| July 1, 1881, amount available | 31,904.17 |
| Amount (estimated) required for completion of existing project | 181,000.00 |
| Amount that can be profitably expended in fiscal year ending June 30, 1883 | 25,000.00 |

PROJECT OF LIEUTENANT-COLONEL WILLIAM P. CRAIGHILL, CORPS OF ENGINEERS

BALTIMORE, MD., *April 27, 1881.*

GENERAL: In accordance with your instructions I have the honor to submit below a project for the expenditure of the appropriation of March 3, 1881, for the New River in Virginia and West Virginia.

The phraseology of the appropriation is the following:

Improving New River from the Lead Mines in Wythe County, Virginia, to mouth of Greenbrier River, $24,000, of which sum $15,000 shall be expended in the continuation of the work from the mouth of Greenbrier up and $9,000 in the continuation of the work from the Lead Mines to Wythe County down.

The general plan of improvement adopted has had reference to a navigation by the boats now in use on the river. This has consisted of making a channel 2 feet deep at ordinary low-water and 18 inches deep at extreme low-water, and varying in width from 30 to 50 feet according to location and direction. In some extraordinary cases, where the channel is necessarily quite crooked, an additional width of from 25 to 50 feet has been given.

This plan involves blasting above and below water and the removal of ledges and bowlders, placing the debris in wing dams and training walls, excavating through gravel shoals and placing the material in the hearts of the dams, and thus making sluices and chutes, affording an improved waterway without too much increasing the velocity and volume of the water in them.

It is proposed to continue this method of improvement in the expenditure of the last appropriation, distributing the work as follows:

3017 1. IN THE SECTION FROM HINTON OR THE MOUTH OF THE GREENBRIER UP

| | |
|---|---|
| To complete work already begun from the mouth of Greenbrier to Lick Creek, 20 miles in extent | $1,500 |
| At mouth of Lick Creek | 250 |
| At Shanklin's Ferry Ledge, 20¼ miles from Hinton | 250 |
| At Shanklin's Ford Shoal, 20¾ miles from Hinton | 2,150 |
| Shoals, 21 miles above Hinton | 450 |
| Walker's Lower Shoals, 21¾ miles above Hinton | 500 |
| Walker's Upper Shoals, 22½ miles above Hinton | 3,100 |
| Pendleton's Ledge, 24 miles above Hinton | 300 |
| Pendleton's Shoals, 24 miles above Hinton | 750 |
| Round Bottom, 24½ miles above Hinton | 700 |
| Shoals, ripples, and ledges between Round Bottom and Wiley's Falls, 25 miles above Hinton | 2,050 |
| Wiley's Falls, 25½ miles above Hinton | 2,500 |
| Surveys (and estimates) of Nellly's Falls, to decide whether a sluice may be made or a lock necessary, 30 miles above Hinton | 500 |
| | 15,000 |

2. IN THE SECTION FROM THE LEAD MINES IN WYTHE COUNTY DOWN

| | |
|---|---|
| Nunn's Ledges, 21.6 miles above New River Bridge | $500 |
| Ledge just below Clark's Falls | 125 |
| Clark's Falls, 22.8 miles above New River Bridge | 950 |
| Clark's Ledges, 22.9 miles above New River Bridge | 550 |
| Lake Island ledge, 23 miles above New River Bridge | 625 |
| Hollingsworth Branch ledge, 23 miles above New River Bridge | 100 |
| Burden's Ledge, 24.8 miles above New River Bridge | 200 |
| Ledge, 25.6 miles above New River Bridge | 100 |
| Crumm's ledges and shoals, 26.6 miles above New River Bridge | 1,300 |
| Howard's ledges, 26.9 miles above New River Bridge | 250 |
| Pine Run Shoals and Rapids, 27.7 miles above New River Bridge | 3,500 |
| Ledge, 31.5 miles above New River Bridge | 150 |
| Sawyer's Shoals, 32 miles above New River Bridge | 150 |
| Survey of Foster's Falls, 37 miles above the bridge, to locate locks and dams (these falls are 18 feet in height) | 500 |
| | 9,000 |

The foregoing distribution is necessarily approximate, but is as near as can be made until the work is actually in hand, which is very irregular in character, and such that accurate estimates and specifications of the details in extent and kind cannot be given. This irregularity has led to the rejection of the contract system on this river up to this time, and to the adoption of the method of procuring materials, boats, and machinery, and labor by open purchase and hire when needed.

It is recommended that this latter method be continued as most economical and satisfactory. It is not expected to expend more than $15,000 of the appropriation in 1881, but to carry the operations over to the end of the fiscal year terminating June 30, 1882.

Very respectfully, your obedient servant,

WM. P. CRAIGHILL,
*Lieutenant-Colonel of Engineers.*

Brig. Gen. H. G. WRIGHT,
*Chief of Engineers, U. S. A.*

3018 *Government exhibit 38*

REPORT OF THE CHIEF OF ENGINEERS, YEAR 1882

(pp. 140–142; 912–919)

23. New River, from the mouth of Wilson, in Grayson County, Virginia, to mouth of Greenbrier, in West Virginia.—From the mouth of Wilson, in Grayson County, Virginia, to steamboat landing at Hinton, Summers County, West Virginia, 1½ miles below the mouth of Greenbrier River, is 191½ miles.

The appropriations have been made in such a manner as to divide this portion of the river into three sections, as follows:

| | Miles |
|---|---|
| Upper or Lead Mines | 62 |
| Middle or New River Bridge | 43 |
| Lower or Greenbrier | 86½ |

Throughout this distance the navigable channel originally consisted of natural chutes, through the ledges and shoals, of varying widths, rarely over 1 foot in depth, in some places so tortuous as to render navigation extremely difficult and dangerous.

The original project adopted for the improvement of these natural channels was to widen them to 30 or 50 feet, as might be required, and deepen them to 2 feet, and straighten such as needed it. This was for keel-boat navigation, the improvement, however, to be made in such a manner as to aid the work should a greater depth and width be required in the future.

A small steamboat, draught 12 inches, when light, having been built at Hinton in the fall of 1878, rendered it necessary to make the channel, in that section, 50 feet wide at all points, and in many from 75 feet to 100 feet, the depth of 2 feet being retained. This steamboat was not adapted in dimensions and power to the navigation of the river, and has been withdrawn.

The original plan of improvement has been adhered to, except that the width of channels on the middle and upper divisions has been reduced to 20 feet, and on the former to 10 feet for
3019 7½ miles, to allow iron to be shipped from the furnaces above.

June 30, 1881, there was a channel from Hinton to Harvey's Ledge, 17½ miles, 50 feet wide and 2 feet deep; at the close of the work in 1881, this channel had reached a point 26½ miles above Hinton.

At the end of the same fiscal year there was a channel from New River Bridge to Peak's Creek, 12 miles, 2 feet deep and 30 feet wide; at the close of the season this was extended to a point 22 miles above New River Bridge.

At the end of the same fiscal year there was nothing done above the Lead Mines, but at the close of the working season of 1881 a channel 2 feet deep and 20 feet wide was made to a point 5⅓ miles above the mines.

Below is shown the miles of river improved from the commencement of the work to close of 1881, since which time little has been done up to June 30, 1882, on account of high river and coldness of the water in which the men must stand to work:

| | 1881 | Previous | Total |
|---|---|---|---|
| | *Miles* | *Miles* | *Miles* |
| Greenbrier division | 9 | 17½ | 26½ |
| New River Bridge division | 10 | 12 | 22 |
| Lead Mines division | 5⅓ | | 5⅓ |
| Total | 24⅓ | 29⅓ | 53⅔ |

On the lower division there are 13 keel-boats and a small side-wheel steamboat, 75 feet long, 10 feet wide, and 3 feet deep, with another 100 feet long and 15 feet wide being built. Four of the keel-boats run up to Shumate's Falls, 28 miles, carrying supplies to the New and East River railroads.

On the middle division there are eight keel-boats, and parties are about to build a small tug-boat and a light draught steamboat to carry ores down to New River Bridge. On the upper division there are no boats, as the improvement is not yet carried far enough.

The tables attached to the report of the superintending engineer show that of the freight shipped from the stations on
3020 the Chesapeake and Ohio Railway, which are outlets to the river on the lower division, 70 per cent. is from New River, an increase over 1880 of 36½ per cent. The shipments from the various stations on the Norfolk and Western Railroad show an increase of 33 per cent. over last year. The navigation of the river not being continuous as yet, it is practically a feeder to the several railroads which cross it and run along portions of it. It has also been of much use in carrying materials and supplies to the railroads while in process of construction near it. While the freighting on the river has increased, the excessive drought of 1881 diminished greatly the amounts of agricultural products to be carried. It is probable that when the river is fully improved boats will transport one-third of all such products and seven-eighths of those of the mines, exclusive of coal.

Operations had been suspended in July for want of funds, but were resumed about the middle of August on the portions of the river within reach of the Chesapeake and Ohio and the Norfolk and Western railroads. The upper section of the river, above the Lead Mines, in Wythe County, being separated from the remainder of the river by Foster's Falls, which are not passable, it has not been deemed expedient to expend the money applicable thereto at this time.

| | |
|---|---|
| July 1, 1881, amount available | $31,904.17 |
| July 1, 1882, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1881 | 28,398.07 |
| July 1, 1882, amount available | 3,506.10 |
| Amount appropriated by act passed August 2, 1882 | 12,000.00 |
| Amount available for fiscal year ending June 30, 1883 | 15,506.10 |
| Amount (estimated) required for completion of existing project | 169,600.00 |
| Amount that can be profitably expended in fiscal year ending June 30, 1884 | 30,000.00 |

G 23

IMPROVEMENT OF NEW RIVER FROM THE MOUTH OF WILSON, IN GRAYSON COUNTY, VIRGINIA, TO THE MOUTH OF THE GREENBRIER RIVER, IN WEST VIRGINIA

The operations on this river in 1881 were begun June 1 and ceased October, 1881. A detailed account of them is given in the following report of Col. W. P. Smith, assistant engineer:

BALTIMORE, MD., *April 28, 1882.*

COLONEL: I have the honor to submit the following re-
3021 port of operations on the improvement of New River, Virginia and West Virginia, for the season of 1881.

GREENBRIER DIVISION

Work was begun June 1 and stopped October 31, only losing eight and one-half out of one hundred and thirty-one working days. The surveys and storing were finished December 24. Three parties worked on the new improvement and a smaller one was kept occupied in strengthening the wall at Indian Creek, straightening the channel at Garten's Ledges, and deepening the waterway at other points, rendered necessary by the prevailing low-water.

Average number of men employed, 57; highest water, 10 feet above and lowest 1 foot below zero. The new work covers a river space, with a channel 50 feet wide and 2 feet deep, of 9 miles, fall in the same 40.55 feet, passing through 17 distinct shoals, falls, and series of ledges, reaching to a point 26½ miles above Hinton, with a total fall in that distance of 102.65 feet.

The wing-dams and training walls built this season, if united would make a wall 1⅓ miles long, 9 feet wide, and 3 feet high. In addition to the above, 800 cubic yards of material were placed in the old walls. Actual cutting through ledges, 6,890 feet for the season.

As yet there is only a narrow channel through Wiley's Falls.

The extreme low-water affected the cost of this work less than on either of the other divisions, but still it was somewhat more expensive, as the estimates were made for the work with a depth of water nearly 6 inches greater than it proved to be.

Bateaux navigated the stream throughout the summer, carrying their usual loads of about 6 tons, which would have been impossible without the improvement.

The work is now in Virginia, but as only a small point of that State puts in here, the work will essentially be for the benefit of West Virginia, as the counties of Monroe and Mercer in the latter State will supply all of the freight, until the improvement reaches the Narrows, 40 miles above Hinton.

3022 The rock encountered was almost entirely a hard sandstone, with more gravel than has been met with heretofore.

A survey of Shumate's Falls in this division, 28 miles above Hinton, was made in July and August, and a map of the same on a scale of 100 feet to the inch, from an examination of which it is found that a channel can be cut through a point of land that puts in at the falls, and obviate the necessity of a lock and dam. At the point, the cutting will be 300 feet long, 55 feet wide at top and 45 feet at bottom, with an average depth of 6 feet. Above this the channel will be cut through the ledges in the river, and below a crib-work—10 feet wide at bottom, 6 feet at top, and 6 feet deep—400 feet long, will be used to hold up the water. Total length of

channel 2,400 feet, with a fall in the same of 10.9 feet, or 0.45 of a foot in 100 feet. This work can be done for $9,000 in round numbers, and the grade is much less than in some other "chutes" through which boats now run successfully. A lock and dam of suitable dimensions for this sort of navigation, at this point, would cost $26,000.

In March, 1882, a careful survey of the shores on the left bank of the river was made at Crump's Ledges, Indian Creek, Crockett's, Warford, and Tom's Run Shoals, to ascertain how much the banks were injured by high-water, and to what extent, if any, this injury was attributable to the improvement.

Seventy-eight per cent. of the freight sent from Hinton came from that portion of New River now being improved; an increase of 36½ per cent. over 1880. Forty-nine per cent. of the freight sent from Lowell came from New River, and 25 per cent. of that received was sent thereto.

NEW RIVER BRIDGE DIVISION

Work was begun June 7 and carried on until October 30, making one hundred and fifteen days out of a possible one hundred and twenty-three. Surveys and storing were finished November 20.

This force was divided into three parties, averaging about twenty men each. Total average, fifty-four. Considerable
3023 difficulty was experienced in getting laborers that would stay on the work; so many railroads and furnaces were being built that the men were constantly going and coming, much to the detriment of the work.

The extreme low-water, this season, increased the amount of work at the points cut through at least fourfold; hundreds of feet had to be taken out, which, with the water 6 inches higher, would not have had to be touched.

The rock encountered was limestone, with ledges nearly vertical; but little gravel.

Highest water 8½ feet above and lowest .92 foot below zero.

The work covers a river space of 10 miles; fall in the same 74.03 feet, passing through nine shoals, falls, and ledges, reaching to a point 22 miles above New River Bridge, with a total fall, in that distance, of 109.38 feet. Actual cutting through the ledges, 8,040 feet for the season. Linear length of walls, 9 feet wide and 3 feet high, 1 mile. Channel from New River Bridge to Peak's Creek, 12 miles and 30 feet wide; from Peak's Creek to Cecil's Ledges, 2½ miles, 20-feet wide, and from Cecil's Ledges to Nunn's Ledges, 7½ miles, 10 feet wide, with a 20-foot channel in the two large ledges of Runyan's Shoals; the channel at all points being 2 feet deep at zero, or ordinary low water.

The 10 foot channel was adopted in order that iron might be shipped from the furnaces, which is now being done from Little Reed Island with 6 batteaux, which carry half loads from the furnace to the head of the improvement, and thence full loads, of from 5½ to 6 tons, to New River Bridge. This 10-foot channel will be widened to 20 feet just as soon as obstructions are removed sufficiently to accommodate the furnaces. Ten-foot channels are not wide enough, as the current is too rapid for the boats in use.

Breeden's Ledges, nearly 25 miles above the initial point, were improved for the shipment of iron ore from the mines to Radford Furnace.

A crane boat and two batteaux were built this season, the former at a cost of $496 and the latter $110 each.

3024 A survey of Foster's Falls, 37 miles above New River Bridge, was made in August and September and mapped, from which it was ascertained that 2 locks of 9 feet lift will have to be built to get around them, together with 1,400 feet of canal 20 feet wide and 4 feet deep. The canal or race belonging to the Pierce Furnace Company can be used for that purpose by deepening it 2 feet, or what will, perhaps, be better, raising the dam at the head of the shoals 2 feet, which will cost about the same. These locks will be at the extreme lower end of the falls, and only far enough apart to allow the length of a boat between. They are to be 110 feet long and 20 feet wide, with 4 feet on the miter sills.

| | |
|---|---|
| 2 locks at $8,000 | $16,000 |
| 850 cubic yards rock cutting, at $2 | 1,700 |
| 5,500 cubic yards earth cutting, at 25 cents | 1,375 |
| 10 percent. for contingencies | 1,907 |
| 10 per cent. for contingencies | 1,907 |
| Total | $20,982 |

These falls are 1,850 feet long, with a fall of 18.2 feet—about 1 foot in 100 feet—and are divided into three sections, as follows:

Lower, 250 feet long; fall 4.3 feet.

Middle, 400 feet long; fall, 5.0 feet.

Upper, 300 feet long; fall, 5.0 feet.

To show that the attention of capitalists has been called to this part of the river, it may be well to state that two parties wish, the one to put on a small tug-boat and the other a light-draught steamboat, to carry ores from the mines down to projected smelting furnaces at New River Bridge, on the Norfolk and Western Railroad.

### LEAD MINES DIVISION

Work commenced June 14 and stopped September 30; ninety working days, out of which eight were lost. Surveys finished

and camp struck October 25. Only one party on this Division, averaging about twenty men, for the season. Highest water 5 feet above, and lowest .88 foot below zero, or ordinary summer water.

This work covers a river space of 5½ miles from the Lead Mines to Wilkinson's Forge, passing through eight shoals
3025 and ledges, with a fall of 49.26 feet in that distance. Actual cutting through ledges, 2,976 feet for the season.

The same difficulties attending the work on the middle division, with regard to labor and low-water, were experienced here. The work stops almost in the middle of Wilkinson's Shoals, which are 1¾ miles long, and until they can be finished the improvement amounts to nothing; in fact, to be useful for the shipment of timber and charcoal, it should be carried at least 4 miles farther, to Crooked Creek.

The rock encountered was limestone, dolomite, sandstone, red and blue shale, river rock, and bowlders.

A crane boat and batteau were built here, at a slightly increased cost over those on the middle division, arising from the fact that the material had to be carried farther.

Cost of solid rock and bowlders on the entire work, $1.87½ per cubic yard; cost of gravel, $1.04. Price of labor, 10 cents per hour up to the middle of September, when it was increased to 12½ cents per hour.

Reference is made to the accompanying tables for details of the work for the season, as well as for commercial statistics with regard to shipments to and from the various railroad stations to which this river is tributary.

Maps on a scale of 100 feet to the inch have been made of twenty-six shoals worked at this season, on the lower and middle divisions, comprised in eleven sheets, and eight shoals on the upper division, on a scale of 800 feet to the inch, in one sheet. Shumate's and Foster's Falls were made on the larger scale mentioned above; also three sheets of gauge readings on each of the divisions. Three tracings, on a scale of 800 feet to the inch, showing the portions of the river improved in 1881, with appropriate references to detail drawings, are herewith transmitted.

J. F. Palmer, R. Hurley, and J. A. Welch are entitled to much credit for zeal and energy displayed as superintendents of the lower, middle, and upper divisions.

3026 The original plan of improvement has been adhered to, except that the width of channels on the middle and upper divisions has been reduced to 20 feet, and on the former to 10

feet, for 7½ miles, to allow iron to be shipped from the furnaces above.

June 30, 1881, there was a channel from Hinton to Harvey's Ledge, 17½ miles, 50 feet wide and 2 feet deep; at the close of the work in 1881, this channel had reached a point 26½ miles above Hinton. At the end of the same fiscal year there was a channel from New River Bridge to Peak's Creek, 12 miles, 2 feet deep and 30 feet wide; at the close of the season this was extended to a point 22 miles above New River Bridge. At the end of the same fiscal year there was nothing done above the lead mines, but at the close of the working season of 1881 a channel 2 feet deep and 20 feet wide was made to a point 5⅓ miles above the mines.

Below is shown the miles of river improved from the commencement of the work to close of 1881:

| | 1881 | Previous | Total |
|---|---|---|---|
| Greenbrier division | 9 | 17½ | 26½ |
| New River Bridge division | 10 | 12 | 22 |
| Lead mines division | 5⅓ | 0 | 5⅓ |
| Total | 24⅓ | 29½ | 53⅚ |

On the lower division there are thirteen keel-boats and a small side-wheel steamboat, 75 feet long, 10 feet wide, and 3 feet deep, with another 100 feet long and 15 feet wide being built. Four of the keel-boats run up to Shumate's Falls, 28 miles, carrying supplies to the New and East River Railroads.

On the middle division there are eight keel-boats, and parties are about to build a small tug-boat and a light-draught steamboat to carry ores down to New River Bridge.

On the upper division there are no boats, as the improvement is not yet carried far enough.

3027 The tables following show that of the freight shipped from the stations on the Chesapeake and Ohio Railway, which are outlets to the river on the lower division, 70 per cent. is from New River, an increase over 1880 of 36½ per cent.

The shipments from the various stations on the Norfolk and Western Railroad show an increase of 33 per cent. The shipments by river to New River Bridge Station began too late in December for any freight to be sent by rail.

The foregoing shows an increase of freight exceedingly good, considering the drought that prevailed throughout the entire river country.

TABLE No. 1.—SHOWING THE DISTANCES FROM STEAMBOAT LANDING AT HINTON, W. VA., TO FOOT OF SHOALS OR LEDGES, THEIR LENGTH AND DIFFERENCE OF LEVEL BETWEEN THE HEAD AND FOOT OF SAME; ALSO THE QUANTITY AND QUALITY OF MATERIAL EXCAVATED IN MAKING AND IMPROVING THE CHANNEL IN 1881

| Shoal or ledge | Distance | Length | Fall | Solid rock and bowlders | Gravel | Total |
|---|---|---|---|---|---|---|
| | *Miles* | *Feet* | *Feet* | *Cu. yds.* | *Cu. yds.* | *Cu. yds.* |
| Ledges and shoals from Hinton to head of Crump's | 16 | 32,130 | 54.81 | 770 | 21 | 791 |
| Harvey's Ledge | 17 1/16 | 100 | .23 | 55 | | 55 |
| Harvey's Falls | 17 3/16 | 680 | 3.44 | 1,101 | 200 | 1,301 |
| Harvey's Ripple | 18 1/16 | 100 | 0.52 | 29 | | 29 |
| Hight's Ripple | 18 3/16 | 200 | 0.96 | 5 | | 5 |
| Deadmore Shoals | 18 1/16 | 550 | 1.21 | 209 | | 209 |
| Deadmore Ripple | 18 3/16 | 100 | 0.32 | 20 | | 20 |
| Anderson's Falls | 19 3/16 | 300 | 2.26 | 559 | 200 | 759 |
| Lick Creek Shoals | 20 | 540 | 1.38 | 384 | | 384 |
| Shanklin's Ledge | 20 1/16 | 150 | 0.99 | 127 | | 127 |
| Shanklin's Shoals | 20 3/16 | 1,700 | 6.52 | 502 | 470 | 972 |
| Island Bar Shoal | 21 | 75 | .20 | 38 | 15 | 53 |
| Island Creek Shoals | 21 1/16 | 400 | 1.30 | 32 | 20 | 52 |
| Walker's Shoals | 22 | 7,680 | 7.04 | 350 | 956 | 1,306 |
| King's Ripple | 24 | 180 | 0.20 | 124 | | 124 |
| Pennington's Ledge | 24 1/16 | 60 | 0.40 | 20 | | 20 |
| Pennington's Shoals | 24 3/16 | 1,900 | 4.97 | 654 | | 654 |
| Wiley's Falls | 26 | 660 | 3.58 | 170 | 60 | 233 |
| Total | | 47,405 | 90.33 | 5,152 | 1,942 | 7,094 |

3028 TABLE No. 2.—SHOWING SAME AS NO. 1 FOR THE MIDDLE DIVISION, WITH NEW RIVER BRIDGE, VIRGINIA, AS THE INITIAL POINT, 1881

| Shoal or ledge | Distance | Length | Fall | Solid rock and bowlders | Gravel | Total |
|---|---|---|---|---|---|---|
| | *Miles* | *Feet* | *Feet* | *Cu. yds.* | *Cu. yds.* | *Cu. yds.* |
| Shoals to Woolwine's Island | 9 9/10 | 11,370 | 22.57 | | | |
| Peak's Creek Ledges | 10 5/16 | 6,661 | 13.48 | 1,378 | | 1,378 |
| Wysor's Shoals | 12 1/16 | 2,750 | 7.00 | 680 | 202 | 882 |
| Linkon's Ledges | 13 1/16 | 1,290 | 4.70 | 236 | | 236 |
| Cecil's Ledges | 14 1/16 | 6,010 | 9.97 | 1,030 | | 1,030 |
| Runyan's Shoals and Ledges | 15 3/16 | 4,800 | 12.90 | 652 | | 652 |
| Allison's Falls | 18 3/16 | 300 | 2.40 | 47 | | 47 |
| Allison's Ledges | 18 7/16 | 3,000 | 9.20 | 289 | | 289 |
| Jones' Ford Shoals | 20 1/16 | 3,000 | 7.30 | 512 | 290 | 802 |
| Breeden's Ledges | 24 3/16 | 750 | 2.00 | 92 | | 92 |
| Total | | 42,931 | 91.52 | 4,916 | 492 | 5,408 |

TABLE No. 3.—SHOWING SAME AS NO. 1 FOR THE UPPER DIVISION, WITH THE LEAD MINES, VIRGINIA, AS THE INITIAL POINT, 1881

| Shoal or ledge | Distance | Length | Fall | Solid rock and bowlders | Gravel | Total |
|---|---|---|---|---|---|---|
| | *Miles* | *Feet* | *Feet* | *Cu. yds.* | *Cu. yds.* | *Cu. yds.* |
| Lead Mine Ledges | 1/4 | 12 | 1.00 | 9 | | 9 |
| Jackson's Island Ledges | 1/8 | 1,120 | 3.00 | 106 | | 106 |
| Zimmerman's Shoals | 1 3/16 | 200 | .60 | 50 | | 50 |
| Porter's Ferry Shoal | 2 1/16 | 400 | 1.35 | 75 | | 75 |
| Roe's Shoals | 3 1/16 | 125 | 1.35 | 20 | | 20 |
| Porter's Ford Shoals | 3 3/16 | 2,000 | 3.00 | | 100 | 100 |
| Roger's Ledges | 4 1/16 | 885 | 7.00 | 460 | | 460 |
| Wilkinson's Shoals and Ledges to Wilkinson's Forge | 4 3/16 | 6,200 | 26.00 | 478 | | 478 |
| Total | | 10,942 | 43.30 | 1,198 | 100 | 1,298 |

ABLE No. 4.—SHOWING THE DETAILS OF BLASTING ON NEW RIVER, VIRGINIA AND WEST VIRGINIA, IN 1881

| Subject | | Division | | | |
|---|---|---|---|---|---|
| | | Lower | Middle | Upper | Total |
| umber of holes drilled | | 2,410 | 3,271 | 893 | 6,574 |
| umber of feet of drilling | | 3,838 | 7,251 | 1,875 | 12,964 |
| umber of blasts fired | | 3,516 | 3,401 | 1,233 | 8,150 |
| umber of blasts missed | | 144 | 130 | 49 | 223 |
| umber of blasts fired under bowlders | | 962 | | 291 | 1,253 |
| verage depth of holes | feet | 1.99 | 2.22 | 2.10 | 2.10 |
| verage drilling per day per drill | do | 15.00 | 13.94 | 11.85 | 13.60 |
| verage charge of powder | pounds | .35 | .39 | .40 | .38 |
| verage loosening of rock per blast | cu. yds | 1.46 | 1.28 | 1.00 | 1.25 |

029 TABLE No. 5.—STATEMENT OF TONNAGE SENT FROM AND RECEIVED AT HINTON AND LOWELL STATIONS, CHESAPEAKE AND OHIO RAILWAY, FROM JANUARY 1, 1881, TO JANUARY 1, 1882

(Furnished by Robert H. Fisher, auditor)

[In tons of 2,000 pounds]

| Articles | Hinton | | New River | | Lowell | | New River | |
|---|---|---|---|---|---|---|---|---|
| | Sent | Rec'd | From— | To— | Sent | Rec'd | From— | To— |
| Lumber | 6,196.80 | (1) | 5,214.00 | (2) | 632.07 | (1) | | (1) |
| Wood | 12.10 | (1) | | (2) | | (1) | | (1) |
| Salt | 1.04 | (1) | | (2) | 1.15 | (1) | | (1) |
| Bacon | 16.44 | (1) | 9.25 | (2) | 3.85 | (1) | 96 | (1) |
| Butter | 4.04 | (1) | 1.01 | (2) | 1.19 | (1) | 40 | (1) |
| Cattle | 137.00 | (1) | | (2) | 1,528.22 | (1) | 1,017.72 | (1) |
| Eggs | 61 | (1) | .20 | (2) | 1.05 | (1) | 26 | (1) |
| Hogs | 7.80 | (1) | | (2) | 43.45 | (1) | | (1) |
| Horses | 19.25 | (1) | | (2) | 11.25 | (1) | 5.62 | (1) |
| Lard | 1.58 | (1) | .54 | (2) | .29 | (1) | | (1) |
| Sheep | 15.00 | (1) | | (2) | 64.08 | (1) | 42.72 | (1) |
| Tallow | .38 | (1) | | (2) | .02 | (1) | | (1) |
| Wool | 8.52 | (1) | 4.95 | (2) | 7.38 | (1) | 1.85 | (1) |
| Corn | 9.40 | (1) | 9.40 | (2) | .02 | (1) | | (1) |
| Dried fruit | 25.91 | (1) | 9.98 | (2) | 11.05 | (1) | 5.52 | (1) |
| Flour | 6.32 | (1) | | (2) | 9.57 | (1) | | (1) |
| Rye | .40 | (1) | | (2) | 1.63 | (1) | 1.08 | (1) |
| Wheat | 141.97 | (1) | 90.80 | (2) | 56.92 | (1) | 37.94 | (1) |
| Flaxseed | 3.25 | (1) | 2.24 | (2) | .47 | (1) | .23 | (1) |
| Hay | 1.03 | (1) | 1.03 | (2) | | (1) | | (1) |
| Leaf-tobacco | 187.45 | (1) | 127.22 | (2) | 115.83 | (1) | 77.22 | (1) |
| Manufactured tobacco | .05 | (1) | | (2) | .10 | (1) | | (1) |
| Oats | 6.01 | (1) | 4.00 | (2) | | (1) | | (1) |
| Whisky | 1.35 | (1) | | (2) | .40 | (1) | | (1) |
| Lime | .50 | (1) | | (2) | | (1) | | (1) |
| Sundries, merchandise | 55.09 | (1) | | (2) | 32.14 | (1) | 16.07 | (1) |
| Sundries, miscellaneous | 165.60 | (1) | | (2) | 47.46 | (1) | 23.73 | (1) |
| Total | | | | | | | | |

[1] Not classified.
[2] Not returned.

TABLE No. 6.—STATEMENT OF TONNAGE SENT FROM THE FOLLOWING STATIONS ON THE NORFOLK AND WESTERN RAILROAD DURING THE YEAR ENDING DECEMBER 31, 1881

(Furnished by E. E. Portlock, auditor)

[In tons of 2,000 pounds each]

| Name of station | Tons | General classification of tonnage | |
|---|---|---|---|
| | | Products | Ton |
| Christianburg | 6,839.42 | Of animals | 10,904.33 |
| Central | 1,483.57 | Of agriculture | 3,042.68 |
| New River | 1,058.86 | Of the forest | 2,601.54 |
| Dublin | 5,993.79 | Of manufacture | 426.56 |
| Martin's | 8,098.19 | Of the mines | 22,515.28 |
| 3030 Max Meadow | 7,078.00 | Of vegetables | 1,135.59 |
| Wytheville | 2,972.72 | Of other articles | 79.64 |
| Crockett's | 5,443.24 | Miscellaneous | 857.47 |
| Rural Retreat | 2,595.29 | | |
| Total | 41,563.09 | | 41,563.09 |

All of the above is from the Upper New River sections, now being improved. Shipments of iron by river only commenced in December 1881, and are not shown. When the river is fully improved it is thought that boats will carry one-third of all the products and seven-eighths of those of the mines, exclusive of coal. The tonnage from these stations is one-third more than in 1880.

Respectfully submitted.

WILLIAM PROCTOR SMITH,
*Assistant Engineer.*

Lieut. Col. WILLIAM P. CRAIGHILL,
*United States Engineers.*

Operations were resumed as early as possible in the spring of 1882. The two causes of delay are usually a high stage of the river and the temperature, as much of the work must necessarily be done by men standing in the water.

GREENBRIER DIVISION

Preparations for work were begun the 1st of May, by building a small bateau, gunwales 36 feet, width 6 feet, and depth 2½ feet, repairing the other bateaux and jolly boats, and making a careful survey of the bank of the river on the side of the chute at Wiley's Falls, 26 miles above Hinton, where camp is established.

Preparations were completed June 1. These falls are 3½ feet high, consisting of two well-defined and several broken ledges of peculiarly hard sand rock. Some work was done here last season, but not sufficient to permit the passage of bateaux at ordinary, much less extreme low water. Although the river continued very

muddy, and never fell lower than 0.4 degree above zero, a channel
120 feet long, from 10 feet to 15 feet wide, and 2 feet deep,
3031 was cut through the falls, and several large bowlders re-
moved from between the ledges, occupying ten men fifteen
days.

The bateaux, of which there are five, carrying supplies to the East River Railroad to Shumate's Falls, 30 miles above Hinton, now get through quite easily, with fair loads, but the channel must be widened to decrease the velocity of the current, and deepened for extreme low-water. Five bateaux run to Lick Creek from Hinton, and four are carrying stores and other products, making fourteen on the river.

NEW RIVER BRIDGE DIVISION

Camp was established May 10, and the time until June 8 occupied in repairing boats and making other necessary preparations for the work. Fifteen days with one party of twenty men were occupied at the following points:

Head of Jones's Ford Shoals, 20.9 miles from New River Bridge, a channel was made 210 feet long, three-fourths of it through solid and the balance through loose rock.

Nunn's Ledges, 21.6 miles above the bridge, a channel was made through five solid ledges, from 25 to 30 feet wide.

Clark's Falls, 22.8 miles from the bridge; solid rock cutting 20 feet wide; fall 2½ feet.

Clark's Ledges, 200 feet above the falls; channel made through the lower one, 60 feet thick.

Total channel way, 415 feet long, 10 feet wide, and 2 feet deep, the cutting averaging 1 foot, covering a river space of 2 miles, and giving navigation for bateaux nearly 23 miles above New River Bridge. Character of rock, limestone and red shale.

This work was done in the two middle weeks of the month, with the water somewhat muddy and a few tenths of a foot above zero or ordinary low-water; the balance of the month it rained nearly every day, keeping the river very muddy and too high for anything to be done, Gauge readings varied from 1 foot above down to zero.

The channel made this season is of great assistance to the
bateaux carrying iron to the Norfolk and Western Railroad,
3032 otherwise the work would not have been done under the
adverse circumstances mentioned above.

Four boats are being used to carry iron from Boone, and the same number from Radford Furnace.

LEAD MINES DIVISION

Nothing done. Funds exhausted.

Labor on the river up to this time has been obtained for 10 cents an hour, but owing to the high price of provisions it is thought that 11 or 12 cents will have to be paid in the future.

Could it have been anticipated that May and June would have been so unfavorable, preparations for work would not have been made so early. Last year these months were as good as any throughout the season.

MONEY STATEMENT

| | |
|---|---|
| July 1, 1881, amount available | $31,904.17 |
| July 1, 1882, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1881 | 28,398.07 |
| July 1, 1882, amount available | 3,506.10 |
| Amount appropriated by act passed August 2, 1882 | 12,000.00 |
| Amount available for fiscal year ending June 30, 1883 | 15,506.10 |
| Amount (estimated) required for completition of existing project | 169,000.00 |
| Amount that can be profitably expended in fiscal year ending June 30, 1884 | 30,000.00 |

3033 *Government exhibit 39*

REPORT OF THE CHIEF OF ENGINEERS, YEAR 1882

(pp. 144–145; 699–705)

23. New River, from the mouth of Wilson, in Grayson County, Virginia, to the mouth of Greenbrier River, in West Virginia.—As has been stated in previous reports, but is here repeated to save trouble in referring to other volumes, the appropriations have been made in such a manner as to divide this portion of the river into three sections, as follows:

| | Miles |
|---|---|
| Upper or Lead mines | 62 |
| Middle or New River Bridge | 43 |
| Lower or Greenbrier | 86½ |

Throughout this distance the navigable channel originally consisted of natural chutes, through the ledges and shoals, of varying widths, rarely over 1 foot in depth, in some places so tortuous as to render navigation extremely difficult and dangerous.

The original project adopted for the improvement of these natural channels was to widen them to 30 or 50 feet, as might be required, deepen them to 2 feet, and straighten such as needed it. This was for bateau navigation, the improvement, however, to

be made in such a manner as to aid the work should a greater depth and width be required in the future.

A small steamboat, draught 12 inches, when light, having been built at Hinton in the fall of 1878, rendered it necessary to make the channel in that section, 50 feet wide at all points, and in many from 75 feet to 100 feet, the depth of 2 feet being retained. This steamboat was not adapted in dimensions and power to the navigation of the river, and has been withdrawn.

The original plan of improvement has been adhered to, except that the width of channels on the middle and upper divisions has been reduced to 20 feet, and on the former to 10 feet for several miles, to allow iron to be shipped from the furnaces above.

3034 Most of the work of 1882, on the Greenbrier Division, was done at Wiley's Falls, in reducing the grade from 1.95 feet in 100 to 72. The length of navigable channel above Hinton on this division is the same, 26½ miles, as reported a year ago, but it has been much improved.

June 30, 1882, there was a channel from New River Bridge to the head of Jones' Ford, a distance of 22 miles, 2 feet deep, 30 feet wide for 12 miles, 20 feet wide for 2½ miles, and 10 feet wide for 7½ miles. During the season of 1882 this channel was extended through 7¼ miles, with a width of 10 feet and a depth of 2 feet to a point 29¼ miles above the bridge.

Nothing was done during the fiscal year on the Lead Mines Division, as it is separated from the remainder of the river by Foster's Falls, which are not passable.

Nothing was done in 1883 before the end of the fiscal year on the whole river. When work ceased in October, 1882, the property pertaining to each division was placed in store, as usual, in charge of a watchman. The assistant engineer was then brought to Baltimore and employed in preparing his report of past work, making drawings showing the condition of the river at the close of the operations of the season, and the progress of the improvement, with estimates of the cost of what yet remains to be done for its completion.

When Congress adjourned March 3, 1883, without provision for further work, it was deemed best and most economical, instead of keeping the property in store at considerable expense for a long time, to collect it at some convenient place and dispose of it. Hinton was the point selected. The day of sale was April 25, 1883, and the amount realized $415.16, which was turned into the Treasury in conformity to law. The assistant engineer was, with regret discharged at the end of May. His services have been of much value.

It has hardly been practicable to accomplish at any one of the very many points needing improvement all that has been desirable, but the worst places have been worked upon to the greatest extent and efforts thus been made to increase the available navi-
3035 gability of the river over as long stretches as possible, and to increase the facilities for access of the greatest number to the railroads touching the river, and thus connecting with the eastern and western markets districts otherwise much isolated and hitherto dependent on teaming to railroad stations over long and bad roads.

Should work be resumed, it will be found difficult to collect and organize as efficient a force as that which has been disbanded and necessarily scattered. To replace such a machine takes time and money.

The number of large boats on the river for carrying freight has increased to twenty-five. The following important facts are taken from the report of the superintending engineer:

Of the freight sent from Hinton in 1882, 95 per cent. came from New River, an increase over 1881 of 46 per cent.

Of the freight received at Hinton in 1882, 43 per cent. went up the river; 24½ per cent. increase on shipments from Hinton in 1882 over 1881; 9 per cent. increase on freight received at Hinton in 1882 over 1881.

In the same order as above, the percentages at Lowell and Hinton Stations, Chesapeake and Ohio Railway combined, were respectively 92½, 46, 14, and 55.

The shipments from the various stations on the Norfolk and Western Railroad, tributary to the river, were not received from the auditor, owing to want of time to prepare them, which is much to be regretted, as it is desirable to have comparisons annually.

The navigation of the river not being continuous as yet, it is practically a feeder to the railroads which cross it and run along portions of it. It has also been of much use in carrying materials and supplies to the railroads while in process of construction near it. It is probable that when the river is fully improved boats will transport one-third of the products of the fine agricultural country through which it flows, and seven-eighths of those of the mines, exclusive of coal.

| | |
|---|---|
| July 1, 1882, amount available | $3,506.10 |
| Amount appropriated by act passed August 2, 1882 | 12,000.00 |
| | 15,506.10 |
| July 1, 1883, amount expended during fiscal year exclusive of outstanding liabilities July 1, 1882 | 12,419.44 |
| July 1, 1883, amount available | 3,086.66 |
| 3036 Amount (estimated) required for completion of existing project | 169,000.00 |
| Amount that can be profitably expended in fiscal year ending June 30, 1885 | 50,000.00 |

H 23

IMPROVEMENT OF NEW RIVER FROM THE MOUTH OF WILSON, IN GRAYSON COUNTY, VIRGINIA, TO THE MOUTH OF THE GREENBRIER RIVER, IN WEST VIRGINIA

The operations on this river in 1882 began in June and ended in October. A detailed account of them is given in the appended report of Col. William Proctor Smith, assistant engineer.

When work on the river ceased in October, 1882, the property pertaining to each division was placed in store, as usual, in charge of a watchman. The assistant engineer was then brought to Baltimore and employed in preparing his report of past work, making drawings showing the condition of the river at the close of the operations of the season and the progress of the improvement, with estimates of the cost of what yet remains to be done for its completion.

When Congress adjourned, March 3, 1883, without provision for work in 1883, it was deemed best and most economical, instead of keeping the property in store at considerable expense for a long time, to collect it at some convenient place and dispose of it. Hinton was the point selected. The day of sale was April 25, 1883, and the amount realized $415.26, which was turned into the Treasury, in conformity to law. The assistant engineer was, with regret, discharged at the end of May. His services have been of much value.

It has hardly been practicable to accomplish at any one of the very many points needing improvement all that has been desirable, but the worst places have been worked upon to the greatest extent, and efforts thus been made to increase the available navigability of the river over as long stretches as possible, and to increase the facilities for access of the greatest number to the railroads touching the river, and thus connecting with the eastern and western markets districts otherwise much isolated and hitherto dependent on teaming to railroad stations over long and bad roads.

3037 Should work be resumed, it will be found difficult to collect and organize as efficient a force as that which has been disbanded and necessarily scattered. To replace such a machine takes time and money.

The statements and statistics in Colonel Smith's report below indicate the value of what has been accomplished. Of the available balance of funds almost the whole pertains to the Lead Mines division, on which it has not been expedient to work during the fiscal year.

MONEY STATEMENT

| | |
|---|---|
| July 1, 1882, amount available | $3,506.10 |
| Amount appropriated by act passed August 2, 1882 | 12,000.00 |
| | 15,506.10 |
| July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882 | 12,419.44 |
| July 1, 1883, amount available | 3,086.66 |
| Amount (estimated) required for completion of existing project | 169,000.00 |
| Amount that can be profitably expended in fiscal year ending June 30, 1885 | 50,000.00 |

REPORT OF COLONEL WILLIAM PROCTOR SMITH, ASSISTANT ENGINEER

BALTIMORE, MD., *May 21, 1883.*

COLONEL: I have the honor to submit the following report of operations on the improvement of New River, Virginia and West Virginia, for the fiscal year ending June 30, 1883.

GREENBRIER DIVISION

Work began June 20, 1882, and ended October 31. Out of one hundred and fifteen working days, fifty-one were lost, nineteen from want of funds in July and August, and the remainder from high and muddy water. The surveys and storing were finished late in December. Only one party, of about thirteen men, was employed. Highest water 11.8 feet above, and lowest 0.2 foot below, zero. Nine-tenths of the time the gauge readings were above ordinary low water. Four distinct rises occurred, delaying operations very much. The greater part of the labor was expended on Wiley's Falls, which consisted in making a cut through hard sandstone, interspersed with iron pyrites, 184 feet long, 50 feet wide, and 3 feet deep, with a fall of 3.58 feet.

3038 Originally the grade was 1.95 feet in 100 feet, but is now reduced to 0.72 foot, obtained by deepening the channel and extending the wall, on the river side, made from the material excavated, to a length of 495 feet, 13 feet wide, and 4 feet high, with another on the land side 274 feet long, of the same width and depth as the former.

The work at Kidwell's Ripple and Wiley's Shoals was, for the most part, done with the crane-boat.

Total length of walls 1,141 feet, 12 feet wide and 3½ feet high. River space worked over 1½ miles, fall in the same 5.83 feet, giving a channel from Hinton to Wiley's Shoals, 26½ miles, 50 feet wide and 2 feet deep; total fall in the entire distance, 104.26 feet, and fall over ledges and shoals 91.98 feet. Actual cutting through ledges, 47.875 feet.

The project for the season called for some work at Warford Shoals and Indian Creek, but as it was found that boats could get through these places very well, and that the work would not be injured by letting them alone, and Wiley's Falls being considered more important, the money was expended there, and, as the work was greater than anticipated in the project, there was no money left for the few shoals above that were estimated for this season.

Whilst the men in bad weather could not work, the boat's crew and some other labor was used in making a more careful survey of the line of the proposed channel through Shumate's Falls, as well as to sink test pits to ascertain the quality of the material to be taken out. This work was done to employ the party and to anticipate a call for a project for the improvement of these falls before the weather would be suitable to make the necessary examinations. A map on a scale of 100 feet to the inch has been prepared, together with a profile of the channel, from which a revised estimate has been made, giving the total cost of the work, in round numbers, at $11,000. The same method of improvement is recommended as suggested in my report for the fiscal year ending June 30, 1882.

A careful survey was also made of the bank of the river at and
3039 below Wiley's Falls, with cross-sections every 50 feet, showing its exact condition previous to cutting the channel, to note in the future whether any damage had resulted therefrom.

On the improved part of the river, in this division, there are nine saw-mills, employing eleven keel-boats and numerous rafts, which cut in 1882, 2,000,000 feet of lumber, 1,800,000 oil barrels, and 100,000 pipe staves, besides twenty car loads of walnut and as many of locust. Their capacity is from 10,000 to 25,000 feet per day. In addition to the above there are six keel-boats on this section of the river, making seventeen in all.

Round Bottom or Pennington's Ferry, 24½ miles above Hinton, is becoming an important place, as the most of the tobacco, grain, &c., from that part of Mercer County is being shipped from that point.

The stave business is following the improvement very closely; a bucking machine is now in operation just below Round Bottom.

The improvement, when it reaches a point 35 miles above Hinton, will give outlet to Peterstown, Monroe County, West Virginia, a thriving place, about 2½ miles from the river, at which there are three mills with a capacity of 58 barrels of flour and one hundred and twenty bushels of meal per day, three tanneries using 1,500 hides per annum, three stores, one saw-mill, and one cabinet shop.

NEW RIVER BRIDGE DIVISION

Work commenced June 8 and ended September 25; only worked forty days out of a possible ninety-eight. Bad weather, high and muddy water, and lack of funds account for the loss of time. One party of about fifteen men, with one overseer for the whole work, was employed. Highest water 7.4 feet above and lowest 0.25 foot below zero. The gauge reading was below zero for only twenty-three days during the season. Worked over a river space of 8 miles, with a fall over shoals and ledges of 36.37 feet, from the head of Jones' Ford to a point in Pine Run Shoals, 1⅛ miles from their foot, one-third of a mile from their head, and, 29¼ miles from New River Bridge, with a channel 10 feet wide and 2 feet deep. To finish Pine Run Shoals will require cutting through four ledges, about 15 feet wide, and give outlet to Barren Spring Furnace, 30.9 miles above the bridge.
3040 Character of rock, limestone and red shale.

The channel gives outlet to Reed Island Creek Furnace at the mouth of Big Reed Island Creek, 26¾ miles above the initial point. In the 8 miles referred to seventy-three ledges were encountered, twenty-seven of which were improved for the 10-foot channel, and nearly all will have to be worked at when the 20-foot channel is made, which should be as soon as Barren Spring Furnace is reached; to do this, it is thought it will be best to go back to the beginning of the 10-foot channel, at the foot of Cecil's Ledges, 14½ miles above the bridge. The increased width is rendered necessary in some places where there is loose rock and gravel, as 10 feet is not wide enough for the current to keep the channel clear; as, for instance, at Jones' Ford and Crumm's Shoals; in fact, the narrow channel was only adopted to give temporary relief to the furnaces.

Total fall from the head of Pine Run Shoals to New River Bridge, 143 feet; fall over shoals and ledges in that distance 129.89 feet; length of walls, 874 feet, 5 feet wide and 2½ feet high.

Owing to the long distance worked over, the frequent removal of camp, and bad weather, the work cost about twice as much as last season.

Something over 900 tons of pig iron were shipped from Reed Island Furnace, 26¾ miles above New River Bridge, to the Norfolk and Western Railroad at the latter point, and 256 tons from Radford Furnace, 18 miles above the bridge.

Eight keel-boats on this division, with a small side-wheel steamboat, 75 feet long, 8 feet wide, and drawing 3 feet, eighteen charcoal furnaces, four forges, four zinc mines, one lead mine, and many deposits of copper await shipment by the river, and

vast forests of the most valuable timber, on the upper division, are kept from market by the non-completion of this work.

LEAD MINES DIVISION

No work this season, but inspectors of the property stored at Wilkinson's Forge, Carroll County, Virginia, were made every sixty days.

An average cost of rock per cubic yard, $2.67, an increase over 1881 of 42 per cent. Cost of gravel, $1.22 per cubic yard.

3041 Taking the total number of cubic yards of material, measured in the walls, removed since the commencement of the work in 1877, and dividing it into the total amount of money expended in that time, it is found that it only cost $2.42 per cubic yard, which shows that the work has been conducted in a very economical manner.

Total number of miles of river improved, 61. The high price of supplies—bacon 20 cents and flour 5 cents per pound—made labor command 12 cents per hour to September 15, and 12½ cents thereafter.

On the 8th of March instructions were received from you to have all of the property belonging to the improvement taken to Hinton, W. Va. On the 17th of March, J. F. Palmer, to whom much praise is due for the efficient manner in which he carried on his work as superintendent last season, as well as for the energy and ability displayed in this movement, commenced that work, and after much difficulty, on account of the weather, low water, and scarcity of labor, succeeded in getting it all at the proper point on the 14th of April, and on the 25th, by your orders, a sale was held, at which everything belonging to the Government was disposed of to the highest bidder.

Of the freight sent from Hinton in 1882, 95 percent came from New River, an increase over 1881 of 46 percent.

Of the freight received at Hinton in 1882, 43 percent went up the river. Twenty-four and a half percent increase on shipments from Hinton in 1882 over 1881. Nine percent increase on freight received at Hinton in 1882 over 1881.

In the same order as above, the percentage at Lowell and Hinton stations, Chesapeake and Ohio Railway, combined, were respectively, 92½, 46, 14, and 55.

The shipments from the various stations on the Norfolk and Western Railroad, tributary to the river, were not received from the auditor, owing to want of time to prepare them, which is much to be regretted, as it is desirable to have comparisons annually.

The tables show the details of the work for the past season, as well as the commercial statistics for the lower division.

3042 Three maps, on a scale of 100 feet to the inch, show the details of the work and surveys at two shoals and two falls on the Greenbrier division, and four maps, on a scale of 200 feet to the inch, show the work at eight shoals and ledges on the Middle or New River Bridge division. The gauge readings on each division were also plotted.

From Hinton, W. Va., to mouth of Wilson Creek, Virginia, the extent of this work is 191½ miles.

Lower Division, 86½ miles; improved, 26⅕ miles.

Middle Division, 43 miles; improved, 29¼ miles.

Upper Division, 62 miles; improved, 5⅓ miles.

Total, 191½ miles; total improved, 60.78 miles.

June 30, 1882, there was a channel 50 feet wide and 2 feet deep from Hinton Landing to Kidwell's Ripple, a distance by river of 25⅕ miles; at the close of the working season for 1882, there was a channel of the same width and depth to Wiley's Shoals, a distance of 26½ miles.

June 30, 1882, there was a channel from New River Bridge to the head of Jones' Ford, a distance of 21 miles, 12 miles 30 feet, 2½ miles 20 feet, and 7½ miles 10 feet wide, and 2 feet deep. During the season for work, 1882, this channel was extended 8¼ miles, to a point above the bridge, 29¼ miles, with a width of 10 feet, and 2 feet deep. No appropriation for the year ending June 30, 1884.

The tables give an exhibit of the commerce of the river in 1882, an increase of nearly 50 percent.

On the entire river there are twenty-five keel-boats and one small side-wheel steamboat.

Respectfully submitted.

WM. PROCTOR SMITH,
*Assistant Engineer.*

Lieut. Col. WM. P. CRAIGHILL,
*U. S. Engineers.*

3043 TABLE NO. 1.—SHOWING THE DISTANCES FROM STEAMBOAT LANDING AT HINTON, WEST VIRGINIA, TO FOOT OF SHOALS OR LEDGES, THEIR LENGTH, AND DIFFERENCE OF LEVEL BETWEEN THE HEAD AND FOOT OF SAME; ALSO THE QUANTITY AND QUALITY OF MATERIAL EXCAVATED IN MAKING AND IMPROVING THE CHANNEL IN 1882

| Shoal or ledge | Distance | Length | Fall | Solid rock and bowlders | Gravel | Total |
|---|---|---|---|---|---|---|
| | *Miles* | *Feet* | *Feet* | *Cu. yds.* | *Cu. yds.* | *Cu. yds.* |
| Hinton to head of Pennington's Shoals | 25 | 46,745 | 86.15 | | | |
| Kidwell's Ripple | 25⅕ | 170 | .60 | 106 | | 106 |
| Wiley's Falls | 26 | 495 | 3.58 | 1,505 | 40 | 1,545 |
| Wiley's Shoals | 26½ | 465 | 1.65 | 126 | | 126 |
| Total | | 47,875 | 91.98 | 1,737 | 40 | 1,777 |

TABLE NO. 2.—SHOWING THE SAME AS NO. 1 FOR THE MIDDLE DIVISION, WITH NEW RIVER BRIDGE, VIRGINIA, AS THE INITIAL POINT, 1882

| Shoal or ledge | Distance | Length | Fall | Solid rock and bowlders | Gravel | Total |
|---|---|---|---|---|---|---|
| | *Miles* | *Feet* | *Feet* | *Cu. yds.* | *Cu. yds.* | *Cu. yds.* |
| Shoals to the head of Jones' Ford | 21 | 42,181 | 89.52 | 22 | | 22 |
| Nunn's Ledges | 21⅓ | 3,000 | 2.98 | 14 | | 14 |
| Clark's Falls | 22¾ | 240 | 2.51 | 40 | | 40 |
| Clark's Ledges | 22½ | 220 | 2.31 | 12 | | 12 |
| Lake Island Shoals | 23 | 3,100 | 6.51 | 42 | | 42 |
| Breeden's Ledges | 24⅝ | 750 | 2.00 | | | |
| Crumm's Shoals | 26 | 2,640 | 6.92 | 78 | 74 | 152 |
| Howard's Ledges | 26⅞ | 4,200 | 1.93 | | | |
| Pine Run Ledges and Shoals | 27⅞ | 7,800 | 11.21 | 53 | | 53 |
| Total | | 64,131 | 125.89 | 261 | 74 | 335 |

TABLE NO. 3.—SHOWING THE DETAILS OF BLASTING ON NEW RIVER, VIRGINIA AND WEST VIRGINIA, IN 1882

| Subject | Division | | Total |
|---|---|---|---|
| | Lower | Middle | |
| Number of holes drilled | 548 | 322 | 870 |
| Number of feet of drilling | 1,186 | 636 | 1,822 |
| Number of blasts fired | 577 | 342 | 919 |
| Number of blasts missed | 4 | 12 | 16 |
| Number of blasts fired under bowlders | 25 | 8 | 33 |
| Average depth of holes, feet | 2.16 | 1.98 | 2.07 |
| Average drilling per day per drill, feet | 12.8 | 12.00 | 12.40 |
| 3044 Average charge of powder, pounds | 0.51 | 0.39 | 0.45 |
| Average loosening of rock per blast, cubic yards | 1.60 | 1.00 | 1.30 |

TABLE NO. 4.—STATEMENT OF TONNAGE SENT FROM AND RECEIVED AT HINTON AND LOWELL STATIONS, ON THE CHESAPEAKE AND OHIO RAILWAY, FROM JANUARY 1, 1882, to JANUARY 1, 1883

(Furnished by Robert H. Fisher, Auditor)

[In tons of 2,000 pounds]

| Articles | Hinton | | New River | | Lowell | | New River | |
|---|---|---|---|---|---|---|---|---|
| | Sent | Received | From | To | Sent | Received | From | To |
| Lumber | 8,153.01 | 286.61 | 7,975.00 | | 1,188.83 | 68.90 | | |
| Wood | | 12.00 | | | | | | |
| Coal | | 954.48 | | | | 73.79 | | |
| Salt | 1.13 | 254.58 | .10 | 120.00 | .14 | 101.28 | | 50.14 |
| Other mineral | | | | | | .27 | | |
| Bacon | 3.06 | 54.50 | 2.06 | 25.00 | .39 | 46.21 | | 30.10 |
| Butter | 1.45 | .17 | .65 | | .60 | | | |
| Cattle | 15.00 | | | | 707.25 | 22.00 | 102.50 | |
| Eggs | .21 | | .09 | | | | | |
| Hogs | .20 | .04 | | | 1.05 | | | |
| Horses | 32.75 | 2.00 | | | 13.75 | 15.00 | 6.90 | |
| Lambs | | | | | 3.20 | | | |
| Lard | .05 | 5.20 | .02 | 2.45 | .86 | | | .40 |
| Sheep | | | | | 66.00 | | | |
| Wool | 7.93 | | 7.00 | | 5.34 | | 3.20 | |
| Corn | 30.47 | 374.35 | 30.47 | 300.10 | 13.21 | 208.07 | | 40.00 |
| Dried fruit | .09 | | .45 | | .18 | .60 | .09 | .30 |
| Flour | 8.82 | 335.39 | | 190.54 | 6.19 | 171.32 | | 101.00 |
| Wheat | 9.99 | 6.38 | 9.10 | | .33 | 3.50 | | |
| Flaxseed | .36 | | .30 | | .25 | | .25 | |

TABLE No. 4.—STATEMENT OF TONNAGE SENT FROM AND RECEIVED AT HIN TON AND LOWELL STATIONS, ON THE CHESAPEAKE AND OHIO RAILWAY FROM JANUARY 1, 1882, TO JANUARY 1, 1883—Continued

| Articles | Hinton | | New River | | Lowell | | New River | |
|---|---|---|---|---|---|---|---|---|
| | Sent | Received | From | To | Sent | Received | From | To |
| Hay | 11.12 | 141.38 | 11.12 | 100.38 | 10.18 | 76.30 | | 40. |
| Leaf-tobacco | 133.80 | | 133.10 | | 86.50 | | 80.50 | |
| Oats | .15 | 1.15 | .15 | 1.00 | | 4.05 | | |
| Manufactured tobacco | 1.56 | 4.80 | .76 | 1.65 | | 2.35 | | 1. |
| Whisky | .30 | 13.01 | | 7.45 | .29 | 17.02 | | 17. |
| Merchandise, sundries | 104.90 | 732.04 | 45.60 | 530.00 | 29.72 | 654.81 | | 450. |
| Carbon oil | .03 | 35.39 | | 22.14 | | 15.99 | | 7. |
| Cement | | 27.30 | | 21.05 | .60 | 29.78 | | 29. |
| Lime | 1.22 | 25.11 | | 5.50 | | 2.10 | | 1. |
| Sundries | 247.40 | 500.48 | 110.08 | 300.18 | 52.68 | 133.47 | 25.00 | 100. |
| Total | 8,765.60 | 3,766.36 | 8,326.02 | 1,627.44 | 2,191.08 | 1,647.68 | 218.44 | 870. |

3050 *Government exhibit 40*

REPORT OF THE CHIEF OF ENGINEERS, YEAR 1884

(pp. 149; 928)

16. New River, from the mouth of Wilson, in Grayson County Virginia, to the mouth of Greenbrier River, in West Virginia.—Nothing was done on this river in the year ending June 30, 1884 and the act of July 5, 1884, contained no further appropriation for it. The balance, $3,079.08, reported as available, pertains by special designation in the law of August 2, 1882, to the portion of the river above Foster's Falls, which are not passable. Its expenditure has seemed of very small benefit and has not been made

MONEY STATEMENT

| | |
|---|---|
| July 1, 1883, amount available | $3,086.08 |
| July 1, 1884, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1883 | 7.00 |
| July 1, 1884, amount available | 3,079.08 |
| Amount (estimated) required for completion of existing project | 169,000.00 |
| Amount that can be profitably expended in fiscal year ending June 30, 1886 | 50,000.00 |

I 16

IMPROVEMENT OF NEW RIVER FROM THE MOUTH OF WILSON, IN GRAYSON COUNTY, VIRGINIA, TO THE MOUTH OF THE GREENBRIER RIVER IN WEST VIRGINIA

Nothing was done on this river in the year ending June 30, 1884

MONEY STATEMENT

(Same as last money statement, supra.)

3051 *Government exhibit 41*

REPORT OF THE CHIEF OF ENGINEERS, YEAR 1885

(pp. 287–288; 1859)

3. New River, from the Mouth of Wilson, in Grayson County, Virginia, to the mouth of Greenbrier River, West Virginia.—As has been stated in previous reports, but is here repeated to save trouble in referring to other volumes, the appropriations have been made in such a manner as to divide this portion of the river into three sections, as follows:

| | Miles |
|---|---|
| Upper, or Lead Mines | 62 |
| Middle, or New River Bridge | 43 |
| Lower, or Greenbrier | 86½ |

Throughout this distance the navigable channel consisted of natural chutes through the ledges and shoals of varying widths, rarely over 1 foot in depth, in some places so tortuous as to render navigation extremely difficult and dangerous.

The original project adopted for the improvement of these natural channels was to widen them to 30 or 50 feet, as might be required, deepen them to 2 feet, and straighten such as needed it. This was for bateau navigation, the improvement, however, to be made in such a manner as to aid the work should a greater depth and width be required in the future.

A small steamboat, draught 12 inches when light, having been built at Hinton in the fall of 1878, rendered it necessary to make the channel in that section 50 feet wide at all points, and in many from 75 feet to 100 feet, the depth of 2 feet being retained. This steamboat was not adapted in dimensions and power to the navigation of the river, and has been withdrawn.

The original plan of improvement has been adhered to, except that the width of channels on the middle and upper divisions has been reduced to 20 feet, and on the former to 10 feet for several miles, to allow iron to be shipped from the furnaces above.

Nothing was done in the year ending June 30, 1884, nor in the year ending June 30, 1885, and the act of July 5, 1884, con-
3052 tained no further appropriation; neither was there an appropriation at the session of 1884–'85. The balance available, $3,000, pertains, by special designation of the law of August 2, 1882, to the portion of the river above Foster's Falls, which are not passable.

Though some anxiety has been manifested by the people interested in that section of the river for the expenditure of this balance, it remains in the Treasury, as the need of it was not apparent until Foster's Falls could be passed. The difficulty about these

falls will, however, considerably disappear when the railroad up Cripple Creek is completed, as boats could then ship to the railroad their freight at Porter's Ferry, above the Lead Mines and the falls.

The navigation of the river not being continuous as yet, it is practically a feeder to the railroads which cross it and run along portions of it. It has also been of much use in carrying materials and supplies to the railroads while in process of construction near it. It is probable that when the river is fully improved boats will transport one-third of the products of the fine agricultural country through which it flows, and seven-eighths of those of the mines, exclusive of coal.

MONEY STATEMENT

| | |
|---|---|
| July 1, 1884, amount available | $3,079.08 |
| July 1, 1885, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1884 | 79.08 |
| July 1, 1885, amount available | 3,000.00 |
| Amount (estimated) required for completion of existing project | 169,000.00 |
| Amount that can be profitably expended in fiscal year ending June 30, 1877 | 25,000.00 |

Submitted in compliance with requirements of section 2 of river and harbor acts of 1866 and 1867.

DD3

IMPROVEMENT OF NEW RIVER FROM THE MOUTH OF WILSON IN GRAYSON COUNTY, VIRGINIA, TO THE MOUTH OF THE GREENBRIER RIVER, IN WEST VIRGINIA

Nothing done on this river during the year ending June 30, 1885.

MONEY STATEMENT

(Same as last money statement, supra.)

3053 *Government exhibit 42*

REPORT OF THE CHIEF OF ENGINEERS, YEAR 1886

(pp. 281-282; 1599-1602)

3. New River, from the mouth of Wilson, in Grayson County, Virginia, to the mouth of Greenbrier River, West Virginia.—As has been stated in previous reports, but is here repeated to save trouble in referring to other volumes, the appropriations have been made in such manner as to divide this portion of the river into three sections, as follows:

| | Miles |
|---|---|
| Upper, or Lead Mines | 62 |
| Middle, or New River Bridge | 43 |
| Lower, or Greenbrier | 86½ |

Throughout this distance the navigable channel consisted of natural chutes through the ledges and shoals of varying widths, rarely over 1 foot in depth, in some places so tortuous as to render navigation extremely difficult and dangerous.

The original project adopted for the improvement of these natural channels was to widen them to 30 or 50 feet, as might be required, deepen them to 2 feet, and straighten such as needed it. This was for bateau navigation; the improvement, however, to be made in such a manner as to aid the work should a greater depth and width be required in the future.

A small steamboat, draught 12 inches when light, having been built at Hinton in the fall of 1878, rendered it necessary to make the channel in that section 50 feet wide at all points, and in many from 75 feet to 100 feet, the depth of 2 feet being retained. This steamboat was not adapted in dimensions and power to the navigation of the river, and has been withdrawn.

The original plan of improvement has been adhered to, except that the width of channels on the middle and upper divisions has been reduced to 20 feet, and on the former to 10 feet for several miles, to allow iron to be shipped from the furnaces above.

3054 There was no appropriation for this river in 1883, 1884, or 1885. July 1, 1886, there was a balance remaining unexpended of $3,000 from the appropriation of August 2, 1882. This pertained by special designation of the law to the portion of the river above Foster's Falls, which are not passable. The balance remained unexpended because of the impassibility of these falls. As the disconnection with routes of transportation caused by these falls would practically disappear on the completion of the railroad up Cripple Creek, and as boats could then ship to the railroad their freight at Porter's Ferry, above the lead mines and the falls, it was concluded to improve the condition of Williamson's Ledges and Shoals. This work was continued as late as the season allowed, a small balance of funds being left unexpended, but not large enough to justify the resumption of operations in the summer of 1886.

The navigation of the river not being continuous as yet, it is practically a feeder to the railroads which cross it and run along portions of it. It has also been of much use in carrying materials and supplies to the railroads while in process of construction near it. It is probable that when the river is fully improved boats will transport one-third of the products of the fine agricultural country through which it flows, and seven-eighths of those of the mines, exclusive of coal.

MONEY STATEMENTS

| | |
|---|---|
| July 1, 1885, amount available | $3,000.00 |
| July 1, 1886, amount expended during fiscal year, exclusive of liabilities outstanding July 1, 1885 | 2,533.43 |
| July 1, 1886, amount available | 466.57 |
| Amount appropriated by act approved August 5, 1886 | 10,000.00 |
| Amount available for fiscal year ending June 30, 1887 | 10,466.57 |
| Amount (estimated) required for completion of existing project | 159,000.00 |
| Amount that can be profitably expended in fiscal year ending June 30, 1888 | 20,000.00 |

Submitted in compliance with requirements of section 2 of river and harbor acts of 1866 and 1867.

## CC 3

### IMPROVEMENT OF NEW RIVER FROM THE MOUTH OF WILSON, IN GRAYSON COUNTY, VIRGINIA, TO THE MOUTH OF GREENBRIER RIVER, IN WEST VIRGINIA

July 1, 1885, there was a balance remaining unexpended 3055 of $3,000 from the appropriation of August 2, 1882. This pertained by special designation of the law to the portion of the river above Foster's Falls, which are not passable. Upon application from parties interested in the navigation of the upper part of the river, in view of the expected construction of a branch railroad up Cripple Creek, which would obviate the difficulty of the impassability of Foster's Falls, and enable the freights from the river to reach the Norfolk and Western Railroad, it was decided to ameliorate the condition of the river at Wilkinson's ledges and shoals as far as the available balance would allow.

Work was commenced September 1, 1885, and continued as long as the weather would permit work in the water. The law having left to the discretion of the Secretary of War to do this work by contract or otherwise, as it might seem most economical and advantageous to the United States, it was decided, in consideration of special circumstances, to dispense with formal contracts, to hire boats and other appliances, as well as the necessary labor.

In 1881 a channel 20 feet wide and 2 feet deep at ordinary low water of summer, was made from the lead mines in Wythe County to within 1,200 feet of Williamson's old forge in Carroll County, a distance by river of over 5 miles. In the autumn of 1885 the channel was continued of the same width and depth for a distance of 1.1 miles to a point 600 feet from the pool of Fowler's Ferry.

The actual cutting amounts to 926 linear feet; the material was made into wing-dams and sustaining walls, of which the combined length was 1,863 feet, with an average width and height of 5 feet and 3 feet, though some were 20 feet wide and 6 feet high. The total material removed amounted to 1,371 cubic yards, at a cost of $1.60 a yard.

The work was prosecuted very vigorously under the immediate superintendence of Col. W. Proctor Smith, formerly of the Corps of Topographical Engineers, United States Army.

MONEY STATEMENT

(Same as last money statement, supra.)

3056 REPORT OF COLONEL W. P. SMITH, ASSISTANT ENGINEER

UNITED STATES ENGINEER OFFICE,
*Baltimore, Md., November 30, 1885.*

COLONEL: I have the honor to make the following report of operations on the improvement of New River, Virginia, during the season of 1885.

In obedience to your instructions I went to Wytheville, Va., on the 21st, and to Ivanhoe Furnace on the 22d of August; on the 24th began preparations for improving Wilkinson's ledges and shoals, 3 miles above. The preparation consisted in building rock-boats and canoes, collecting tools, blacksmith supplies, powder, lumber for shelter for men, and to build turning-dams, and getting the same to the part of the river to be improved, making and putting up water-gauges, building blacksmith shop, making an examination of the ledges, and staking out enough of the channel to begin work, which took until the end of the month.

On the 1st of September the actual work in the river commenced, and continued without interruption until the 10th of October, with the loss of only one day from bad weather. On the 12th of October a hard rain set in, which caused the river to rise 3 feet, and the weather turning cool the work was stopped.

A survey of the part of the river which had been worked over was begun on the 14th, and finished on the 17th, which ended operations for the season in the field.

Wilkinson's shoals and ledges began about 4½ miles above the lead mines, and are 1¾ miles in length. They consist of series or groupes of ledges running entirely across the river, which, owing to bends in the stream, had, at points, to be followed in their general direction north 64° east, and at others crossed diagonally and at right angles. The ledges for the most part consist of blue and red slate, the latter often interspersed with iron pyrites and flint; some of them rise 5 or 6 feet above the surface of ordinary summer water. The fall in these ledges is 54.1 feet. The total fall from Fowler's Ferry, at the head of these shoals, to the lead mines is 79.12 feet in a distance of 6¼ miles.

3057 Between the ledges referred to, a great many bowlders of

hard sandstone are found, with here and there small quantities of gravel and sand and a few loose rock.

In 1881 a channel, 20 feet wide and 2 feet deep, at ordinary summer water, was made from the Lead Mines Dam in Wythe County to within 1,200 feet of Wilkinson's old forge in Carroll County, a distance by river of a little over 5 miles. This forge was swept away by the great flood of September, 1878.

On September 1 work was commenced at the point of leaving off in 1881, continuing the channel, of the same width and depth, for a distance of 1 1/11 miles; to the upper or summit ledge, 600 feet from the Fowler's Ferry Pool, a point it was expected to reach this season, and which would have been done had the weather continued favorable one week longer.

In making the channel spoken of, thirty-nine groups, containing one hundred and forty-three distinct ledges, from 6 inches to to 15 feet in thickness, were encountered, as well as from eighty to one hundred bowlders, which, in the absence of a crane-boat, had to be blasted and then removed, as they were too large to be removed by rolling or lifting by hand.

The actual cutting through the ledges amounts to 926 linear feet, averaging 2 feet in depth, the material from which was made into wing-dams and sustaining walls, whose combined length amounts to 1,863 feet, with an average width and height of 5 feet and 3 feet, although some of them were 20 feet wide and 6 feet high. These walls contain 1,035 cubic yards of material and 336 cubic yards wasted; making the total amount of material removed equal to 1,371 cubic yards, at a cost of $1.60 per yard, which is very cheap, and is accounted for by the means used of hiring tools from the contractors of the Cripple Creek Railroad and the New River Mineral Company at a very low rate. No estimate of the cost of loose rock, gravel, and sand was attempted, as the quantity of each was insignificant.

The heaviest work of the season was found in the last 800 feet, where the channel had to be cut through nine groups of ledges, the fall over which is 13½ feet; over some of these ledges
3058 the water was very swift, rendering it difficult to make turning-dams stay in their places. There were also some rock encountered about half way, where, as stated before, the ledges were full of pyrites and flint, making it very hard to drill.

To complete the work to the head of the ledges, a distance of 600 feet, there will be encountered ten small ledges over which the fall is very slight, which can be taken out at an estimated cost of $300.

The work occupied thirty-four days, with an average, all told, of thirty-two men, whose wages were $1 per day of ten hours until the 17th of September, when the time was reduced to nine

hours, and still further to eight hours October 4, owing to cold weather and short days. The laborers boarded themselves and were sheltered in temporary sheds, and some occupied buildings found near the work.

The gauge-readings were below zero or ordinary summer water the whole time, the lowest being 0.95 feet below and the highest 3 feet above zero, the latter occurring during the survey after the work had stopped. For about ten days the water was muddy, which retarded operations somewhat, but on the whole the stage of the river and the weather were excellent. Five hundred holes were drilled to an average depth of 2.17 feet, 724 blasts were fired with an average charge of powder of 0.8 pounds, loosening about 1.7 cubic yards of material per blast. Six hundred pounds of powder were used, contained in 1,087 cartridges 8 inches long and 1¼ inches in diameter. The powder was Hercules No. 2, containing 40 per cent of nitro-glycerine, its lack of strength causing more to be used than heretofore, but the price being about half of that formerly used compensated for the greater quantity. Five thousand feet of double tape-fuze were consumed and 1,225 linear feet of holes drilled. Charcoal was used in the blacksmith shop, at a cost of 5 cents per bushel, purchased in the immediate vicinity of the work.

The month of November was consumed in getting up material for and preparing this report, and in plotting the notes of survey and making maps therefrom. Of the latter, two were made of the upper part of Wilkinson's ledges and shoals, showing the work in detail, and of scales, respectively, 200 feet and 800
3059 feet to the inch; one of the river from the Lead Mines down to the head of Wilkinson's Shoals, at Fowler's Ferry, on a scale of 800 feet to the inch, showing the work in general throughout that distance, a tracing of which accompanies this report.[10] A graphic description of the guage readings for the season was also made for preservation in the office.

The Cripple Creek Railroad, which is partially built, starts from Martin's (now called Pulaski) Station, on the Norfolk and Western Railway, in Pulaski County, Virginia, strikes New River about 5 miles below the mouth of Red Island Creek, crosses soon after to the right bank and follows it to Jackson's Ford, when it crosses to the left bank and runs up to Snow Hill Branch, about 2¾ miles above the Lead Mines, which it follows, crossing the divide to Cripple Creek at Brown Hill Furnace, and thence up the creek, passing Ivanhoe Furnace, belonging to the New River Mineral Company, located on Snow Hill Branch, about 200 yards from New River at Porter's Ferry. The work on this

[10] Tracing omitted.—W. P. C.

road was temporarily suspended last June, but orders have been issued for its immediate resumption.

Whilst the work of building the Cripple Creek Railroad was going on, the owners of two saw-mills, between 8½ and 9½ miles above the Lead Mines, with a capacity of 5,000 feet per day, hauled their lumber to the head of the channel just below the Forge and then shipped it by raft to different points along the river and railroad. Another saw-mill is also in existence up Crooked Creek, 9 miles above the mines, the lumber from which will be shipped by raft as soon as the railroad work gets in full operation. There is a large quarry on the river just below Porter's Ford, the stone from which was boated down the stream, through the channel, to the railroad, and will be again when the material is needed.

The channel made this season will benefit these rafts when a rise of about 1 foot occurs, but to do much good the balance of these shoals should be removed and the work carried on through Early's, Elley's, and the Gulf Shoals to a point near Grayson Sulphur Springs between 9 and 10 miles above the mines; in fact, for shipping lumber and minerals the channel should be made as projected, to the mouth of Wilson in Grayson County, 62 miles above the Lead Mines.

Hitherto the obstruction offered to navigation by Foster's
3060 Falls, about 6 miles below the mines, almost rendered it useless to expend the money appropriated for the division under consideration. The construction of the Cripple Creek Railroad, however, abrogates this and puts this division on a par with those of Greenbrier and New River bridge, for its objective point is a railroad as well as that of the other two, and timber and minerals can just as easily be taken to market therefrom.

No bateaux in use on this part of the river as yet, and there will not be until the channel is made up the river a sufficient distance to make their use profitable. There are, however, one-half dozen large boats for carrying stone lying idle at the quarry referred to, ready for use as soon as times get more prosperous.

As the work stood June 30, 1882, there was a navigable channel 20 feet wide and 2 feet deep at ordinary low water above the Lead Mines Dam for a distance of a little over 5 miles. At the end of this season this distance has been increased to 6¼ miles.

It is not necessary to say anything about the other two divisions of New River, as there was no work done on them, nor were the channels examined; but from inquiries it is thought that the channel-way made in former years still keeps open, and bateaux are in constant use on them, iron having been shipped to New River bridge up to the time of the suspension of the furnaces by the prevailing hard times.

It is not thought necessary to give a description of the wonderful resources of this section of country in minerals, timber, and agricultural products, for the subject is thoroughly treated in your reports to the Chief of Engineers, United States Army, to be found in the annual report of that officer as follows: 1873, Appendix T; 1875, Appendix W; 1879, Appendix F.

Respectfully submitted.

WM. PROCTOR SMITH,
*Assistant Engineer.*

Lieut. Col. WM. P. CRAIGHILL,
*United States Engineer Corps.*

3061 *Government exhibit 43*

House Executive Documents, 1st Session, 52nd Congress, 1891–1892, Vol. 3

Report of the Secretary of War, Vol. 2—1891, Engineers, Part 1

(5) New River, from the mouth of Wilson, in Grayson County, Virginia, in the mouth of Greenbrier River, West Virginia. The appropriations have been made in such manner as to divide this portion of the river into three sections as follows:

| | Miles |
|---|---|
| Upper, on Lead mines | 62 |
| Middle, on New River bridge | 43 |
| Lower, on Greenbrier | 86½ |

throughout this distance the navigable channel consisted of natural chutes through the ledges and shoals of varying widths, rarely over one foot in depth, in some places so tortuous as to render navigation extremely dangerous and difficult.

The original project adopted for the improvement of its natural channels was to widen them to thirty or fifty feet, as might be required, deepen them to two feet, and straighten such as need it. This was for bateau navigation; the improvement, however, to be made in such a manner as to aid the work should a greater depth and width be required in the future.

A small steamboat, draft twelve inches when light, having been built at Hinton in the fall of 1878, rendered it necessary to make the length in that section fifty feet wide at all points, and in many from seventy-five feet to one hundred feet, a depth of two feet being retained. This steamboat was not adapted in dimensions and power to the navigation of the river and was withdrawn.

The original plan of improvement has been adhered to, except that the width and the length of the middle and upper divisions

has been reduced to twenty feet, and on the former to ten feet for several miles, to allow the iron to be shipped from the furnaces above.

There was no appropriation for this river in 1883, 1884
3062 or 1885. July 1, 1886, there was a balance remaining unexpended of $3,000 from the appropriation of August 2, 1882. This pertained by special designation of the law to the portion of the river above Foster's Falls, which was not passable. The balance remained unexpended because of the impassability of these falls. As the disconnection with routes of transportation caused by these falls would practically disappear on the completion of the railroad up Cripple Creek, and as boats would then ship to the railroad their freight at Porter Ferry, above the lead mines and fields, it was concluded to improve the condition of Williamson Ledges and Shoals. This work was continued as long as the season allowed and small balance of funds being left unexpended, but not large enough to justify the resumption of operation in the summer of 1886.

There was an appropriation of $10,000 in the law of August 5, 1886, applicable only to the portion of the river above Lead-mines. When the money became available it was too late to commence operation in 1886. For more than one reason it seemed inexpedient to expend this appropriation in the year ending June 30, 1888. The portion of the river to which it is applicable is above Foster Falls, and this can only be passed by one or two locks. There are also strong reasons for doubt whether, considering the present development of that section of the country, the construction of such locks would be justified, even if the money were available. The construction of railroads near this stream had diminished very much the importance of the improvement of the portion of reconnaissance of the river and its vicinity, and it was decided to postpone the expenditure of the appropriation until the will of Congress could be further ascertained.

In the River and Harbor Act of August 11, 1888, it was, however, directed that the balance be spent in improving the river between Ivanhoe Furnace, in the Wythe County, and the mouth of Wilson Creek. Operations in accordance with these directions were therefore commenced June 9, 1889, and continued until October 10, 1889.

In 1885 there was a channel two feet deep and twenty feet wide from Ivanhoe Furnace to within six hundred feet of the head
of Wilkinson Shoals and Ledges, a distance of 3.9 miles.
3063 In 1889 this channel, with the same width, and depth was extended to the lower end of the approach to the Gulf, a distance of five miles from the initial point, with four-tenths

of a mile further up the river, partially improved. There were no operations on the river in the year ending June 30, 1891, and thereafter no expenditures in that fiscal year. The balance of $2,341.79 remains from the last appropriation, which was in August 1886.

In compliance with the recommendation of the local engineer, it was decided by the Secretary of War not to expend the existing balance at present.

MONEY STATEMENT

| | |
|---|---|
| Up to June 30, 1891, the amount expended was | $109,733.21 |
| July 1, 1890, balance unexpended | $2,341.79 |
| July 1, 1891, balance unexpended | 2,341.79 |
| Amount (estimated) required for completion of existing project | 159,000.00 |

Submitted in compliance with requirements of Section 2 of River and Harbor Acts of 1886 and 1887.

115

IMPROVEMENT OF NEW RIVER, VIRGINIA AND WEST VIRGINIA

After the suspension of the operations for some years for want of funds an appropriation of $10,000. was made August 6, 1886, applicable, however, only to the portion of the river above the Lead Mines in Wythe County. [illegible]ginia.

Doubt having arisen, in view of the changed condition of affairs on and near the river, as to the propriety of expending this appropriation at once, it was decided by proper authority to defer operations until the will of Congress could be further ascertained.

In the River and Harbor Act of August 11, 1888, it was directed that the balance should be spent in improving the river between Ivanhoe Furnace in Wythe County, and the mouth of Wilson Creek. Operations in accordance with this direction were commenced in June 1889 and continued until October 10, 1889.

3064 The work done was in the neighborhood of Ivanhoe Furnace, and was continued until necessarily suspended by high water. A balance of $2,341.79 was left, which still remains. The expenditure on this river up to 1886 were highly useful, but since that time the situation has changed. In a report of April 17, 1891, given below, it was recommended that the remaining balance be not spent at present. To this the Secretary of War agreed.

MONEY STATEMENT

(Same as last money statement, supra.)

(For balance of this exhibit see original exhibit 43.)

3065 *Government exhibit 44*

House Documents, Vol. 3, No. 2

Reports of War Department, Engineers, Pt. 1, 55th Congress, 2nd Session, 1897

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NEW RIVER, VIRGINIA AND WEST VIRGINIA

In its original condition the navigable channel consisted natural chutes through the ledges and shoals; the chutes were varying widths and there was rarely over one foot of water such points.

The original project was adopted in 1875 (report printed the Annual Report of the Chief of Engineers for 1893, pp. 84 854) and provided for improving the stream from the lead min in Wythe County, Virginia to the mouth of Greenbrier Rive West Virginia, by widening the channels from 30 to 50 feet, might be required, deepening them to 2 feet and straightenin such as needed it for bateau navigation; the improvement, hov ever, to be made in such manner as would aid the work shoul greater depth and width be required in the future.

The extension of the improvements from the lead mines i Wythe County, Virginia, up to the mouth of Wilson Creek i Grayson County, Virginia, was provided for in the act of Co gress of June 14, 1880. (Report on pp. 113–139, part 2 of th Annual report, of the Chief of Engineers for 1875, and repo on pp. 538–545, part 1, of the Annual report of the Chief o Engineers for 1879.)

The sum of $109,691.06 was expended up to June 30, 1896, fo open river navigation.

There were no expenditures during fiscal year ending June 3 1897. The unexpended balance is, by the act of Congress o August 5, 1886, available for expenditure between the lead mine and Wilson Creek. As conditions have changed in late years the future improvements of that portion of the stream has bee reported as entirely unnecessary, and the Secretary of War
3066 has decided not to expend the existing balance at present

| | |
|---|---|
| July 1, 1896, balance unexpended | $2,308.9 |
| July 1, 1897, " " | 2,308.9 |

F. F. 7

Improvements of New River, Virginia and West Virginia (this work was in the charge of Col. Peter C. Hains, Corps of Engineers, until April 30, 1897).

The charge of the improvements of the New River was transferred to me on April 30, 1897, by Col. Peter C. Haines, Corps of Engineers, in accordance with instructions in letter of the Chief of Engineers to Colonel Hains, dated April 17, 1897.

The balance unexpended was furnished by the act of Congress on August 5, 1886, with the stipulation; "continuing improvements between the lead-mines, in Wythe County, and the mouth of Wilson's Creek in Grayson County." By letter dated April 17, 1891, it was reported to the Chief of Engineers that further improvements of that portion of the stream was wholly unnecessary, on account of changed conditions in late years. The Chief of Engineers, under date of April 23, 1891, stated that the Secretary of War had decided that the unexpended balance should be withheld from expenditure until further action is taken by Congress. Nothing has, therefore, been done toward improving the stream since that time.

MONEY STATEMENT

| | |
|---|---|
| July 1, 1896, Balance unexpended | $2,308.94 |
| July 1, 1897, Balance unexpended | 2,308.94 |

3067 *Government exhibit 45*

Fifty-Seventh Congress, Sess. 1, Ch. 1079, 1902

The River and Harbor Appropriation Act of 1902 being Chapter 1079, Act of June 13, 1902, provides as follows:

REPEAL OF PROVISIONS IN FORMER ACTS

SEC. 7. That the provisons of river and harbor Acts heretofore passed providing for the prosecution of work upon the following projects are hereby repealed, and any amounts heretofore appropriated for any of the same now remaining unexpended shall be paid into the Treasury of the United States, to wit: Pensaukee Harbor, Wisconsin; New River, Virginia and West Virginia; Wolf Lake, Indiana; Chippewa River, Wisconsin; Yellowstone River, Montana and North Dakota. 32 Stats. at large, 331,374.

3068 *Government exhibit 46*

62D Congress, 3d Session. House of Representatives. Document No. 1410

NEW RIVER FROM RADFORD, VA., TO HINTON, W. VA.

Letter from the Secretary of War, transmitting, with a letter from the Chief of Engineers, report on examination of New River, from Radford, Va., to Hinton, W. Va. February 20, 1913.—Referred to the Committee on Rivers and Harbors and ordered to be printed, with illustration.

WAR DEPARTMENT,
*Washington, February 19, 1913.*

SIR: I have the honor to transmit herewith a letter from the Chief of Engineers, United States Army, dated 17th instant, together with copy of a report from Maj. F. W. Altstaetter, Corps of Engineers, dated November 21, 1912, on preliminary examination of New River, from Radford, Va., to Hinton, W. Va., made by him in compliance with the provisions of the river and harbor act approved July 25, 1912.

Very respectfully,

HENRY L. STIMSON,
*Secretary of War.*

The SPEAKER OF THE HOUSE OF REPRESENTATIVES.

3069

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
*Washington, February 17, 1913.*

From: The Chief of Engineers, United States Army.
To: The Secretary of War.
Subject: Preliminary examination of New River from Radford, Va., to Hinton, W. Va.

1. There is submitted herewith, for transmission to Congress, report dated November 21, 1912, by Maj. F. W. Altstaetter, Corps of Engineers, on preliminary examination of New River, from Radford, Va., to Hinton, W. Va., called for by the river and harbor act approved July 25, 1912.

2. New River rises in western North Carolina and flows in a general northerly direction, uniting with the Gauley River to form the Kanawha River. Hinton is located 57 miles above the mouth and Radford 84 miles farther up. The river flows through a sparsely settled, rugged mountain country. From Hinton to

the head of slackwater in the Kanawha River, a distance of 64 miles, the fall is almost 750 feet. The whole section is unfavorable for navigation and the district officer states that the river above it could not be connected with navigation in the Kanawha by the expenditure of any reasonable amount. The stretch under consideration must therefore be considered independently. From the investigation made by the district officer, it appears that there is no demand for river improvement over this section, and that an improvement of value would require the construction of locks and dams at considerable cost. He is of opinion that the river between Hinton and Radford is not worthy of improvement by the United States, and in this opinion the division engineer concurs.

3. This report has been referred, as required by law, to the Board of Engineers for Rivers and Harbors, and attention is invited to the board's accompanying report of December 23, 1912, concurring with the views of the district officer and the division engineer.

4. After due consideration of the above-mentioned reports, I concur in general with the views of the district officer, the division engineer, and the Board of Engineers for Rivers and Harbors, and therefore, in carrying out the instructions of Congress, I report that the improvement by the United States of New River, from Radford, Va., to Hinton, W. Va., in the manner apparently desired by the interests concerned as described in the reports herewith, is not deemed advisable at the present time.

W. H. BIXBY,
*Chief of Engineers, U. S. Army.*

3070 REPORT OF THE BOARD OF ENGINEERS FOR RIVERS AND HARBORS.

(Third indorsement)

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
*December 23, 1912.*

THE CHIEF OF ENGINEERS, UNITED STATES ARMY:

1. Hinton is located at the confluence of New River and the Greenbrier, 57 miles above the mouth of New River and 64 miles above the head of slack-water navigation on the Kanawha River. On this reach the fall is 750 feet, and navigation is therefore impracticable. Radford is 84 miles above Hinton, the fall on this reach being 348 feet, or over 4.1 feet per mile. The upper 54 miles of this reach—Glenlyn to Radford—is paralleled for most of

the way by two railroads. From Glenlyn to Hinton, 30 miles, the fall is 128 feet. There is no railroad along the banks of this portion of the stream, but the district officer states that no part of it is more than 15 miles from a railroad.

2. There is no navigation on the reach between Radford and Glenlyn and none is demanded by those in the vicinity who were given an opportunity of expressing an interest in the subject. Some indefinite expressions of interest were shown in regard to the reach between Glenlyn and Hinton, but these were vague and appeared to recognize the fact that the great fall in the river would preclude any form of continuous navigation, except through slack watering the stream.

3. The country adjacent is sparsely settled, and the chief occupation of the inhabitants is farming and stock raising. Just above Radford some iron ore is mined and there are some small lead mines in that vicinity.

4. About $110,000 has been expended on this river in improving the bars by building chutes or sluiceways through them. This afforded possible light-draft navigation and was used to some extent a number of years ago. But little has been done on this river since 1882. There is a very small commerce carried on in the lower part of the reach under consideration by the use of so-called keel boats, which are towed or poled. There being no connection with the river below, the commerce is local.

5. The district officer reports that between Glenlyn and Radford there is no particular need or demand for improvement, and that between Hinton and Glenlyn the commerce is small and the depth of the water now maintained is sufficient for present demands. He therefore reports that the river is unworthy of improvement, and in this view the division engineer concurs.

6. Interested parties were advised of the unfavorable report of the district officer and given an opportunity of presenting their views to the board, but no communications on this subject have been received.

3071 7. There is very little commerce on this river at present, and as there are no commercial or mining industries of importance, no material increase could be expected even if it were improved. Physical conditions are such that it could not be improved for useful navigation except at prohibitive cost. The board, therefore, reports, concurring with the views of the district officer and the division engineer, that it is not advisable for the United States to undertake the improvement of New River from Radford, Va., to Hinton, W. Va.

8. In compliance with law, the board reports that there are no questions of terminal facilities, water power, or other related sub-

jects which could be coordinated with the suggested improvement in such manner as to render the work advisable in the interests of commerce and navigation.

For the board:

WM. T. ROSSELL,
*Colonel, Corps of Engineers,*
*Senior Member of the Board.*

PRELIMINARY EXAMINATION OF NEW RIVER FROM RADFORD, VA., TO HINTON, W. VA.

WAR DEPARTMENT,
UNITED STATES ENGINEER OFFICE,
*Wheeling, W. Va., November 21, 1912.*

From Maj. F. W. Altstaetter, Corps of Engineers.
To: The Chief of Engineers, United States Army (Through the Division Engineer).
Subject: Preliminary examination of New River from Radford, Va., to Hinton, W. Va.

1. In compliance with letter of August 3, 1912, from the department, the following report on the preliminary examination of New River from Radford, Va., to Hinton, W. Va., is submitted, as required by the river and harbor act approved July 25, 1912.

2. The New River rises in western North Carolina and flows in a general northerly direction, uniting with the Gauley River to form the Kanawha River. Hinton is located 57 miles above the mouth of New River, and Radford is 84 miles farther up, or 141 miles above the mouth. The drainage area above Hinton is 5,600 square miles and above Radford 2,725 square miles. Drawing K 12/51 (inclosed herewith) shows the river from Hinton and Radford and also its position with respect to the main lines of transportation in the vicinity.

3. The entire New River flows through sparsely settled rugged mountain country. There are no towns of any size between
3072 Hinton and Radford. According to the census of 1910, the population of the adjacent counties was as follows:

| | |
|---|---|
| Summers County, W. Va | 18,420 |
| Mercer County, W. Va | 38,371 |
| Monroe County, W. Va | 13,055 |
| Giles County, Va | 11,623 |
| Pulaski County, Va | 17,246 |
| Montgomery County, Va | 17,268 |

The principal cities are Radford and East Radford, Va. (6,202); Pearisburg, Va. (646); Hinton and Avis, W. Va. (5,088). There is a small hamlet of Glenlyn, with a population of 52, situated 30 miles above Hinton, where the Norfolk & Western and Coal & Coke Railroads leave the river.

4. The inhabitants are engaged chiefly in farming and stock raising. There is a small quantity of timber and staves marketed. There is no underlying coal, the New River fields being some distance from the section under consideration. Just above Radford some iron ore is mined, and there are also some small lead mines in that vicinity.

5. From Hinton to the head of slack water in the Kanawha, a distance of 64 miles, the fall is almost 750 feet. There are many bridges and steep rapids along this portion, including Kanawha Falls, which is about 16 feet high. This whole section is unfavorable for navigation, and the river above it could not be connected with navigation in the Kanawha by the expenditure of any reasonable amount. The navigation between Hinton and Radford must therefore be considered as having no outside river connection. The Chesapeake & Ohio Railroad parallels the river from Hinton to its mouth and continues on down the Kanawha River.

6. Physical characteristics.—From Hinton to Radford the river is shown by seven drawings [11] (inclosed herewith), marked K 12/52, 53, 54, 55, 56, 57, and 58. A survey of this river was made in 1873, and maps of that survey with other information obtainable were used in preparing the above drawings. The river has a breadth varying from 500 to over 1,000 feet, with an average breadth of about 600 feet. The lowest published discharge measured at Radford is given as 1,830 cubic feet per second, but as the discharge in the Kanawha River has been measured as low as 1,100 cubic feet per second, that in the New River is probably lower than indicated above. From a study of the gauges at Radford and Hinton and other sources it appears that at extreme low water the controlling depths over the bars may drop to less than 1 foot. This is due to the great rapidity of the current, the drop between these two places being about 348 feet. The headwaters of the river being in some of the highest mountains east of the Rockies a good discharge is ordinarily maintained, and 2 feet found over the bars.

From Hinton to the vicinity of Glenlyn a boat drawing 2 3073 feet will have sufficient depth of water for navigation at practically all times. Mean stage conditions give 3 feet over nearly all bars. The river, however, partakes of the characteristics of a mountain stream, with very rapid current and bad rapids, and therefore navigation is dangerous on it.

The drop of the surface of the water is shown in the profiles on the drawings. This whole country has outcroppings of rock over much of the area. The river bottom and banks are rock in many places, so that little change has taken place in years except that

[11] Not printed.

the iron-ore washings in the upper river have deposited sediment in the quieter and deeper reaches, and where improvements have been made at the bars loose stones placed there have been moved.

The valley is generally narrow, with many steep bluffs frequently rising sheer from the water's edge. At places there is a narrow bench of fertile soil lying quite low, but most of it is well above flood stages.

The Weather Bureau reports 14 feet as a flood stage, both at Hinton and at Radford. At the Radford gauge the extreme variation of water recorded is 36 feet, while at Hinton it is 22.5 feet.

7. Previous examinations, etc.—The previous examinations and reports on this portion of the New River have been made as follows:

First. Survey of 54 miles of the river between Sinking Creek and Greenbrier River was made in 1819 by Moore and Griggs, under the auspices of the board of public works of the State of Virginia, with a view to connecting the waters of the James and Kanawha Rivers by that route.

Second. Examination for 128 miles from the lead mines in Wythe County to the mouth of the Greenbrier River at Hinton. (See Annual Report Chief of Engineers, 1873, pp, 78 and 842.)

Third. Examination of the New River, W. Va., at its confluence with the Greenbrier River. (See Annual Report Chief of Engineers for 1904, pt. 3, p. 2617.)

8. Work done.—The only work done in the past has been the improvement of some of the bars by building a channel chute or sluiceway across them. This channel was about 50 feet wide and 2 inches deep at extreme low water, and was made by cutting out rock where necessary and piling up stones along the sides of the chute to direct the water through it. The work extended from Hinton for a distance upstream of about 25 miles. About $110,000 was expended in this work. The last work was done in 1882, except for the expenditure of $10,000, and the chutes have deteriorated in the meantime due to the natural action of ice and the current.

3074 9. Commerce.—Above Glenlyn the river is paralleled most of the way by two railroads, and there is no river commerce. From Hinton to Glenlyn, a distance of 30 miles, there is some commerce, consisting of lumber, staves, sand, gravel, and also some grain, hay, farm products, and miscellaneous merchandise. No statistics are on hand, but I am informed that the commerce at Hinton amounts to about two railroad carloads per day, and, as Hinton is the only town on this 30-mile section, this is some measure of its amount. This estimate of two carloads a day is thought to be excessive and is believed to be true only at times. In 1883 there were about 17 keel boats in this traffic, and there are said to be 10 or 12 such boats now on the river. These keel boats, as they are called, are the popular boats for this traffic,

having an average length of 60 feet, width of 6 to 8 feet, and carrying 20,000 to 27,000 pounds. Their draft is generally about 2 feet. The commerce is altogether local. During the winter season, from December 1 to April 1, the roads are in poor condition, and the inhabitants experience difficulty in transportation of supplies. The section from Glenlyn to Hinton lies almost entirely in Summers County and only traverses about one-half of it. Summers County had a population, at the last census, of 18,420. Probably no more than 2,000 or 3,000 people at most are in any way dependent upon this section of the river. The improvement of the river would probably cause a small increase in commerce, but not a very large one, as there is nothing to move.

10. Obstructions.—The following is a list of bridges, with principal span, and clearance above low water:

| | |
|---|---|
| Norfolk & Western Ry. bridge at Radford: | |
| Principal span | 130 feet |
| Clearance | 31 feet 7 inches. |
| Highway bridge at Radford: | |
| Principal span | 114 feet. |
| Clearance | 57 feet 2 inches. |
| Norfolk & Western Ry. bridge near Pepper: | |
| Principal span | 140 feet. |
| Clearance (about) | 33 feet. |
| Highway bridge at Eagleston: | |
| Principal span | 225 feet. |
| Clearance | 34 feet 5 inches. |
| Norfolk & Western Ry. bridge at Ripplemead (Big Stoney): | |
| Principal span | 110 feet. |
| Clearance | 32 feet. |
| Highway bridge at Ripplemead: | |
| Principal span | 150 feet. |
| Clearance (estimated) | 32 feet. |
| Highway bridge at Narrows, Va.: | |
| Principal span | 216 feet 9 inches. |
| Clearance | 27 feet 8 inches. |
| Virginia Ry. bridge at Glenlyn: | |
| Elevation extremely high. No data as to dimensions. | |
| Highway bridge at Hinton: | |
| Principal span | 242 feet 6 inches. |
| Clearance (middle of second span) | 53 feet 5 inches. |

3075 There are no dams in this section of the river.

11. Improvement desired.—The inhabitants between Glenlyn and Radford seem to have no desire whatever to have the river improved. The following are quoted from statements made by some of the citizens in this section:

"Can see no advantage in the project, that part of the State being well provided for with railroads.

"Never heard of anyone who wanted any improvement of the river.

"Think the cost would be very excessive for the benefits that would be derived.

"The idea is entirely new to me; never heard it discussed.

"Do not know of any demand for an improvement.

"Do not think any use would be made of the slack water if provided.

"Do not know of any demand for river improvement.

"Regard this scheme as entirely impracticable; in fact, consider it foolish to contemplate.

"See no demand, either present or prospective, for slackwater navigation.

"Do not think it practicable to improve a short piece of the river without an outlet in the Ohio, which is, of course, impracticable."

From Glenlyn to Hinton inquiry among the inhabitants revealed no one who had heard anything about a possible improvement, but they were more favorably impressed with the idea than the inhabitants in the section from Glenlyn to Radford. Briefly, they favored some form of slack-water navigation, and thought that the river was not suitable for improvement except by slack water. The following are statements made by various prominent citizens of this section:

"Anxious to see something done that would open up the country.

"Consider it would be more advantageous for a pool of water from Narrows to Hinton.

"Think that section certainly needs something done to develop it.

"Think that section of river between Glenlyn and Hinton deserves an improvement.

"Think it probable that most of the timber adjacent to the river has been cut, but there remain great quantities of staves, ties, bark, etc., that will continue for years and that could profitably be shipped by water.

"The chutes made years ago by the Government are used by bateaux in shipping sawed lumber, etc.

"Consider this the worst tied-up country I ever saw."

12. Conclusions and recommendations.—Between Glenlyn and Radford there is no particular need for improvement of the river and no particular demand for it. Between Hinton and
3076 Glenlyn there is no point more than 15 miles from the railroad, and that is not an excessive distance to go by wagon. The number of people and the amount of commerce to be benefited by improvement is small. The depth of water now maintained over this reach is sufficient for the present demands of commerce the principal objection being the swift current. This could be obviated only by slack-water improvement, which

would require 10 dams with a lift of 18 feet each, or their equivalent. It is not believed that the river between Hinton and Radford is worthy of further improvement and it is recomended that no survey be made.

ADDITIONAL SUBJECTS

13. Terminal facilitjes.—There are practically no terminal facilities for river traffic along this entire section and no mechanical appliances except a simple elevator at Hinton for loading crossties into railroad cars. This is owned by the Chesapeake & Ohio Railroad Co., is seldom used, and is available to the public. There being such little commerce, there seems to be no special demand for terminal facilities.

14. Water power.—Due to the great fall of the river, the narrow sparsely inhabited valley, and the large low-water discharge of the New River, the question of using the water power would merit considerable attention should the river ever be improved by means of locks and dams; in fact, water power could be developed in such large quantities that if a combined water power and navigation project should ever be carried out, navigation would probably be a secondary consideration. At Kanawha Falls, below Hinton, a water-power plant is now established, while above Radford water power is also being developed in the New River. As the total fall from Glenlyn to Hinton is 128 feet and the low-water discharge probably over 1,000 cubic feet per second, the amount of water power available is apparent. Above Glenlyn the presence of the railroads, which are quite near the water surface, would complicate the matter should high dams be built. Coal, however, is very cheap in this vicinity, so that water-power development may not be as attractive as appears on the surface.

15. Other subjects.—There are no other subjects deserving of consideration in this connection.

F. W. ALTSTAETTER.

(First Indorsement)

OFFICE DIVISION ENGINEER, CENTRAL DIVISION,
*November 29, 1912.*

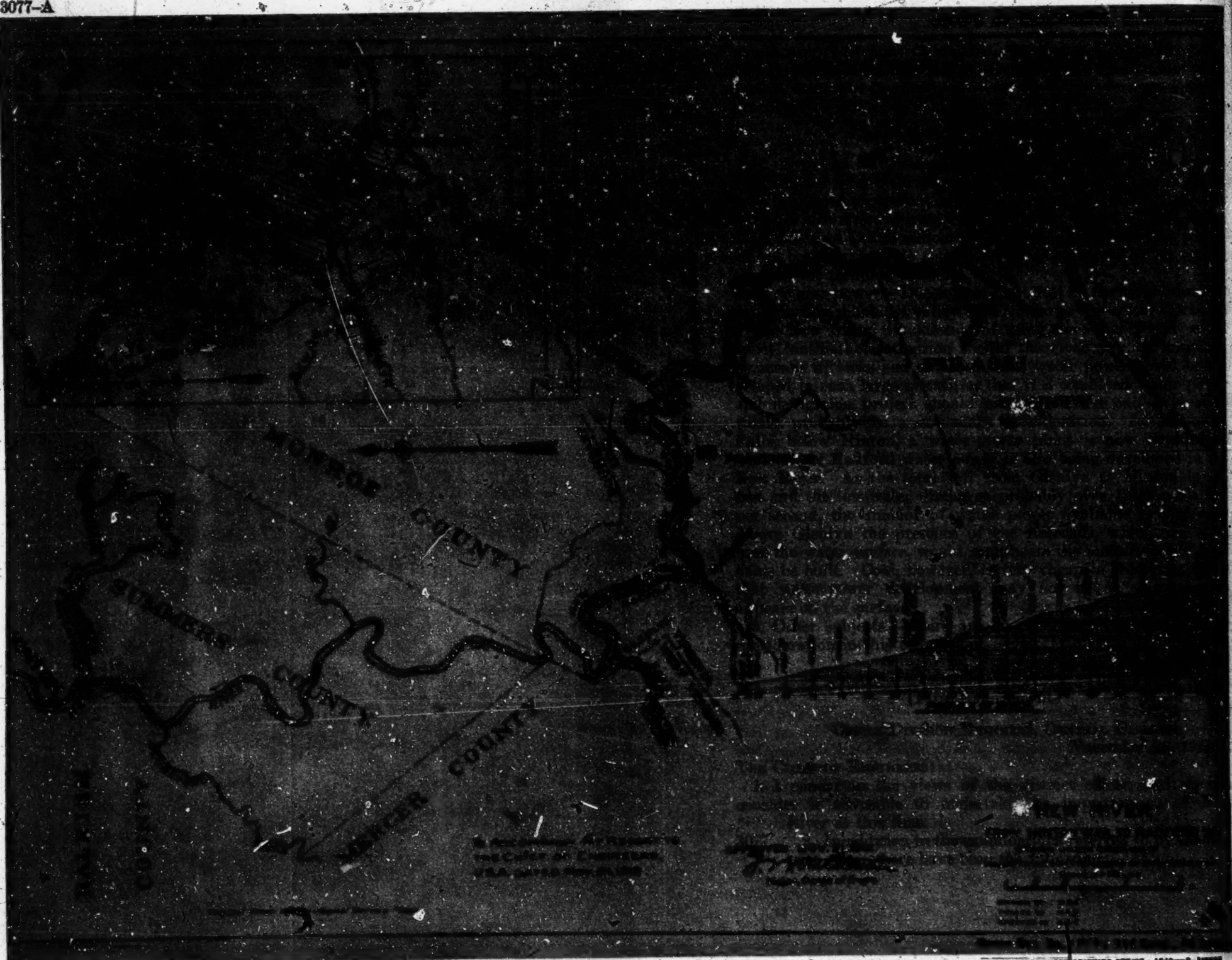
The CHIEF OF ENGINEERS:

1. I concur in the views of the district officer, and do not consider it advisable to undertake the improvement of New River at this time.

3077 2. In addition to the examinations referred to by the district officer there have been the following:

2425-A

3077-A




U. S. GOVERNMENT PRINTING OFFICE : 1940—O-310000

Examination from the lead mines in Wythe County to the "Mouth of Wilson" in Grayson County, Va. (Annual Report for 1875, pt. 2, p. 133.)

Survey from lead mines in Wythe County to the mouth of Wilson Creek in Grayson County, Va. (S. Ex. Doc. No. 41, 45th Cong., 3d sess.; Annual Report for 1879, pt. 1, p. 538.)

3. The report of Col. William P. Craighill, Corps of Engineers, recommending suspension of work on New River, is given in the Annual Report for 1891, part 4, page 2431.

H. C. NEWCOMER,
*Lieut. Col., Corps of Engineers,*
*Division Engineer.*

(For Report of the Board of Engineers for Rivers and Harbors, see p. 3.)

3078 *Government exhibit 47*

(pp. 1-3; 12-39)

Letter from the Secretary of War. April 21, 1913.—Referred to the Committee on Commerce and ordered to be printed.

WAR DEPARTMENT,
*Washington, April 18, 1913.*

The PRESIDENT OF THE SENATE.

SIR: In response to Senate resolution dated April 8th instant, directing the Secretary of War "to furnish to the Senate, if consistent with public interests, copies of all documents and papers in his office or under his control relating to the building of dams or reservoirs by private interests in the Cheat and New Rivers, in the States of Virginia and West Virginia, and copies of all correspondence had with his department relating thereto, together with copies of all rulings or permits, if any, issued or made by his department authorizing the building of any such dams or reservoirs." I have the honor to transmit, herewith, photostat copies of all papers, correspondence, rulings, permits (without maps), etc., of record in the department pertaining to the construction of dams or reservoirs by private parties in Cheat and New Rivers, Va. and W. Va.

Very respectfully.

LINDLEY M. GARRISON,
*Secretary of War.*

LYNCHBURG, VA., *November 7, 1899.*

SECRETARY OF WAR.

DEAR SIR: Will you please inform me whether the New River of Virginia is under your jurisdiction by reason of its navigability or not.

In other words, I desire to know respecting building dams; and hence if you have any control over such matter, 3079 kindly inform me between what points.

Your prompt attention to this will greatly oblige.

Yours, etc.,

PETER J. OTEY, *M. C.*

Can you not send me some publication regarding the matter?

(Second indorsement)

OFFICE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
*November 9, 1899.*

Respectfully returned to the Secretary of War.

New River rises in North Carolina and crosses the line between that State and Virginia nearly at the mouth of Wilson Creek in Grayson County. After flowing in a general easterly direction from the mouth of Wilson Creek, it turns down again into Alleghany County, N. C., whence it soon recrosses into Virginia, thence into West Virginia, where it forms a junction with the Gauley.

The whole of the river from Wilson Creek to its mouth has been surveyed from time to time under the direction of Congress. In 1879 a survey of that portion in Grayson County was surveyed and projects for its improvement submitted. At the time this survey was made that portion of the river was not used for transportation purposes, only the ordinary canoe used for ferrying and fishing being seen; but it was stated by the officer who made the survey that a study of the regimen of the river showed that "there is an abundance of water for any system of navigation that may be inaugurated."

Projects were presented:

1. For keelboat navigation with a channel not less than 2 feet deep and 30 feet wide, by rock excavation, removal of bowlders, sand, and gravel, etc., $115,000.

2. For steamboat navigation with channel depths of 3 feet and 5 feet, at cost of $1,200,000 and $1,600,000, respectively.

By the rivers and harbors act of June 14, 1880, Congress
3080 appropriated $24,000, for improving the river from the mouth of Wilson, in Grayson County, to the mouth of the Greenbrier River, in West Virginia, and additional appropriations were made in the acts of 1881, 1882, and 1886.

Work was carried on under these appropriations, until 1889, when it was suspended on account of changed conditions which lessened the usefulness of the river as a means of transportation, such as the great development of the railroad systems paralleling the river.

The cost of canalizing this river would be very great and out of all proportion to the benefits to be derived now or in the near future, and at the present time this river is not considered worthy of further improvement by the General Government, but the country is rich in minerals and agricultural products, and as these become enlarged the importance of the river as a natural transportation route may increase to such an extent as to lead Congress to adopt a slack-water system of improvement.

While no work has been carried out on this river for the past 10 years and while there is not understood to be any actual navigation at the present time on the section of the river over which it is desired to construct a dam, it would appear that the action heretofore taken by Congress has indicated its opinion that the New River is a navigable water of the United States, and that under the existing laws the consent of Congress is necessary before a dam can be legally built thereon.

A pamphlet containing the laws on the subject is herewith.

A. MACKENZIE,
*Acting Chief of Engineers.*

WAR DEPARTMENT,
*Washington, November 10, 1899.*

Sir: In response to the request contained in your letter of 7th instant, I have the honor to transmit herewith copy of a report of the Acting Chief of Engineers, United States Army, relative to the navigability of New River, Va., also a pamphlet containing the laws on the subject.

Very respectfully,

ELIHU ROOT,
*Secretary of War.*

Hon. PETER J. OTEY,
*Lynchburg, Va.*

3081 LAWS FOR THE PROTECTION AND PRESERVATION OF THE NAVIGABLE WATERS OF THE UNITED STATES

(Pamphlet containing excerpts on the River and Harbor Acts for 1899, 1902, 1894, 1900, and 1905 is omitted.)

(Scott & Staples, attorneys at law, 608–9–10, Terry Building.)

ROANOKE, VA., *November 7, 1899.*

DEAR SAM: Col. Fries, of Winston, wants to know whether or not New River in Grayson County is a navigable stream or under the dominion of the Federal Government. He is interested with a company which wants to build a dam across the river 6 miles above Grayson Springs on or near Chestnut Yards, on the Norfolk & Western Railroad. If the river is not navigable, the owners of the land on the bank of the river, or riparian owners, own to the middle of the stream. If the river is navigable, they own only to low-water mark. If the river is not navigable, they can get authority from the county court of Grayson County to put a dam across the river. If it is navigable, they have to get the consent of the Federal Government.

It is of the utmost importance that they should know about this matter before the 15th. Will you please go to the War Department and ascertain there all the information you can for me on the subject, and let me know. If you discover tomorrow that you cannot get the information yourself, please telegraph me, and if necessary I will go to Washington and get it.

All are as well as usual. Mary Kellogg is up and about again. Let me hear from you as soon as possible, and if necessary for me to get the information that I should go to Washington, telegraph me tomorrow and I will leave here tomorrow night or the next day.

Your affectionate brother,

ABRAM P. STAPLES,

WAR DEPARTMENT,
*Washington, November 11, 1899.*

SIR: Referring to the letter addressed to you by Abram P. Stables, of Roanoke, Va., expressing a desire to secure
3082 information relative to the navigability of New River, Va., I beg to invite attention to the accompanying copy of report of the Acting Chief of Engineers, United States Army, on the subject, which it is thought contains the information desired.

Very respectfully,

ELIHU ROOT,
*Secretary of War.*

Dr. SAMUEL GRANVILLE STAPLES,
*1416 Twentieth Street, NW., Washington, D. C.*

HOUSE OF REPRESENTATIVES, U. S.,
*Washington, D. C., March 13, 1900.*

RETARY OF WAR.

EAR SIR: Will you kindly give me any information in your session in regard to New River, Va., as a navigable stream. ase see inclosed letter and favor me by returning it with full wer, and oblige.

Yours, etc.

PETER J. OTEY.

(Second indorsement)

OFFICE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
*March 19, 1900.*

espectfully returned to the Secretary of War.

lew River rises in North Carolina and crosses the line between t State and Virginia nearly at the mouth of Wilson Creek in ayson County. After flowing in a generally easterly direction m the mouth of Wilson Creek, it turns down again into Alle- ny County, N. C., whence it soon recrosses into Virginia, thence o West Virginia, where in forms a junction with the Gauley er.

he whole of the river from Wilson Creek to its mouth has been veyed from time to time under the direction of Congress.

By the river and harbor act of June 14, 1880, Congress appro- ated $24,000 for improving the river from the mouth of Wilson Creek in Grayson County, Va., to the mouth of Greenbrier 3 River in West Virginia, and additional appropriations were made in 1881, 1882, and 1886.

Work was carried on under these appropriations until 1889, en it was suspended on account of changed conditions which ened the usefulness of the river as a means of transportation, h as the great development of the railroad systems paralleling river. Radford, the locality mentioned in the within com- nication, is between the mouth of Wilson Creek and the mouth the Greenbrier River, and consequently is on the stretch of river for the improvement of which Congress has made appro- ations.

While no work has been carried out on this river for the past years, and while there is not understood to be any actual navi- ion on the section of the river over which it is desired to con- uct a dam, it would appear that the action heretofore taken Congress has indicated its opinion that New River is a navi- le water of the United States and, under the existing laws, the sent of Congress is necessary before a dam can legally be built reover.

A pamphlet containing the laws of Congress on the subject is herewith, and attention is invited to section 9 of the act of March 3, 1899.

JOHN M. WILSON,
*Brig Gen., Chief of Engineers, U. S. Army.*

WAR DEPARTMENT,
*Washington, March 19, 1900.*

DEAR SIR: Referring to previous correspondence on the subject, and especially to your letter of 18th instant requesting information respecting New River, Va., especially as to whether it is held to be a navigable stream, I beg to inclose herewith for your information a copy of a report of the Chief of Engineers of this date, together with the pamphlet therein referred to containing the laws of Congress on the subject, and inviting attention to section 9 of the act of March 3, 1899.

Very respectfully,

G. L. MICKLEJOHN,
*Acting Secretary of War.*

Hon. PETER J. OTEY,
*House of Representatives.*

3084 IN RE THE APPLICATION MADE TO CONGRESS BY F. H. FRIES AND W. C. RUFFIN, OF THE STATE OF NORTH CAROLINA, FOR PERMISSION TO ERECT A DAM ACROSS NEW RIVER, IN GRAYSON COUNTY, VA.

The following data and explanation thereof have been collected and arranged for consideration in connection with the above application:

Col. F. H. Fries and Mr. W. C. Ruffin propose to erect a cotton mill on the bank of New River, in Grayson County, Va., about 6 miles above Grayson Spring, and near the mouth of Stephens Creek, and contemplate the expenditure thereon of something over half a million dollars. To this end, they have made application to the authorities of the State of Virginia, as provided by law, for their permission to erect across the said river a dam to supply the water power for this enterprise. The State authorities have authorized the erection of the dam across said river at said point, the evidence of which is in the following records:

To the HONORABLE J. C. PADGETT,
*Judge of the County Court of Grayson County, Va.:*

Your undersigned commissioners, J. B. Waugh, H. W. Clark, R. L. Dickenson, T. L. Gwyn, and F. H. Ward, who were appointed by the order of your honorable court to meet on the site of the proposed mill and dam and canal on New River, on the 5th day

of April, 1900, and inquire and ascertain whether the mansion house of any person or the outhouses, yards, gardens, or orchards thereto belonging will be overflowed or taken by the erection of the proposed dam or the construction of the proposed canal, and whether and in what degree ordinary navigation and the passage of fish will be obstructed thereby, whether by any, and if any, and by what means such obstruction might be prevented, and whether the health of the neighbors will be injured by the stagnation of waters or otherwise, and with directions to circumscribe so much of the lands not owned by the applicants as will be necessary for the canal, dam, or work to be constructed as aforesaid, not being (beyond what is in the bed of the watercourse) more than one acre for a dam, nor more than 100 feet in width for a canal, and to ascertain what will be a just compensation therefor, and the lands which will probably be overflowed or deprived of water, or otherwise injured by such canal or dam, or be injured by the construction of the work aforesaid shall likewise be examined by them, and they shall ascertain what will be a just compensation to the several owners thereof for the damages to the same, respectively, and to report their proceedings to court, beg leave to submit the following report:

On the 6th day of April 1900, your undersigned commissioners, having first been duly sworn according to law, assembled on the site of the proposed dam, mill, and canal. The certificate of their oath is attached to this report.

That the site of the proposed mill is on the north side of New River, near where Eagle Bottom Creek empties into the same, and not far from the residence of Alfred G. Bartlett, and on the lands of F. H. Fries and W. C. Ruffin.

They find that the site of the proposed dam is across New River, above the upper line of the Jones and Littrel tract, and below the mouth of Stephens Creek; and that the said F. H. Fries and W. C. Ruffin own the land on both sides of the river within the points above designated. They find that the proposed
3084-A canal will extend from the said dam to the said mill site, and will die exclusively within the boundaries of the lands of the said F. H. Fries and W. C. Ruffin.

Your commissioners further report that neither the mansion house nor the outhouses, yards, garden, or orchards of any person will be overflowed or taken by the erection of the proposed dam, or the construction of the proposed canal, provided the dam be not in excess of 30 feet in height.

They report that New River at this point is not navigable, and, therefore, the erection of a dam at this point will not in any way interfere with navigation.

They further report that the effect of the erection of the proposed dam will be to obstruct the passage of fish, unless a proper fish ladder is constructed, but if such fish ladder be constructed, then the obstruction by the erection of a dam will be prevented.

They report that the health of no one will affected by stagnant water or otherwise.

They report that no water raised or backed by the erection of the said dam will flood any lands except those owned by the said F. H. Fries and W. C. Ruffin, or the lands on which they have acquired water rights, and have liquidated and settled any contingent or possible damage.

They find that no one will be damaged by the erection of the said dam, or the backing or overflowing of water resulting therefrom.

They further report that there will be no deprivation of water to any person which will operate or interfere with the use of New River below the said dam for any mill purpose, or otherwise, and that no one will be damaged in any way by any deprivation of the water resulting from the erection of the dam, construction of the mill, or the operation.

J. B. WAUGH,
H. W. CLARK,
R. L. DICKENSON,
T. L. GWYN,
F. H. WARD.

VIRGINIA, *County of Grayson, to wit:*

I, T. C. Vaughan, a notary public in and for the county and State aforesaid, do hereby certify that J. B. Waugh, H. W. Clark, R. L. Dickenson, T. L. Gwyn, and F. H. Ward this day personally appeared before me in my State and county aforesaid and made oath that they will, each and every one of them, well and truly perform their duties as commissioners to examine into and report to the county court their findings as to damages in the matter of the application of F. H. Fries and W. C. Ruffin to erect a dam across New River, to construct a canal, and to build a mill, engines, and other machinery.

Given under my hand this the 5th day of April, 1900.

THOS. C. VAUGHAN, *Notary Public.*

VIRGINIA, *Grayson County Court, April 6, 1900:*

On motion of F. H. Fries and W. C. Ruffin for leave to build a dam across New River, and build a mill, and open a canal on the lands of the said F. H. Fries and W. C. Ruffin.

This day, April 6, 1900, came F. H. Fries and W. C. Ruffin by their attorneys and the commissioners heretofore appointed by an order of the county court of Grayson County, entered on the

3d day of April, 1900, upon the motion of said F. H. Fries and W. C. Ruffin, to go upon the lands and real estate set out in the application for the appointment of said commissioners, having returned their report to court on this day, and there being no exceptions to said report, and no one appearing to contest said application, and said report showing that no one will be damaged by the erection of the dam, the digging of the canal, and the erection of the mill for which leave is sought, and it appearing that said proposed canal is wholly upon the lands of said applicants, it is ordered that said report be, and the same is hereby, confirmed, and the said applicants are hereby authorized and empowered to erect, construct, and make the dam, canal, and mill as requested in said application.

And it is further ordered that the said applicants erect a suitable fish ladder for the passage of fish over and across said dam.

VIRGINIA, *Grayson County, to wit:*

I, F. J. Lundy, clerk of the county court of Grayson County in the State of Virginia, do hereby certify that the foregoing is a true copy of the report of the commissioners made and returned under an order of the said county court of Grayson, on the 3d day of April, 1900, appointing them for the purposes contemplated by section 1347 of the Code of Virginia, 1887, and which is fully set out in the report aforesaid, together with a copy of the order of the said county court, confirming said report.

3084-B Given under my hand and seal of the said county court of Grayson County this 11th day of April, 1900.

[SEAL.] F. J. LUNDY,
*Clerk Grayson County Court.*

VIRGINIA, *Grayson County, to wit:*

I, J. C. Padgett, judge of the county court of Grayson County, in the State of Virginia, do hereby certify that F. J. Lundy, whose name is signed to the foregoing certificate, is the duly elected and qualified clerk of the said court, and that due faith and credence should be given to his said certificate.

Given under my hand this 19th day of April, 1900.

J. C. PADGETT,
*Judge of the County Court of Grayson County, Va.*

VIRGINIA, *County of Grayson, to wit:*

I, F. J. Lundy, clerk of the county court of Grayson County, in the State of Virginia, do hereby certify that J. C. Padgett, whose name is signed to the foregoing certificate, is the duly commissioned and qualified judge of the county court of Grayson County, Va., and that due faith and credit should be given to his said certificate.

In testimony whereof, I have hereunto this 19th day of April 1900, affixed my hand and seal of the county court of Grayson County, Va.

[SEAL.] F. J. LUNDY,
*Clerk of the County Court of Grayson County, Va.*

And since action was at one time taken by Congress looking to the improvement of New River in this section, for purposes of limited navigation, it is deemed advisable to secure from Congress permission to erect the dam across the said river at the locality mentioned.

The first action taken by Congress looking to the improvement of this section of New River is found in the river and harbor bill of June 23, 1876, volume 18, of the Statutes at Large, part 3, page 237, which directs the Secretary of War—

"to cause examinations or surveys or both to be made at the following points: On New River from the lead mines in Wythe County to the 'mouth of Wilson' in Grayson County, Va."

It does not appear from the report of the Chief of Engineers of the Army for the year 1876 (C. Appendix S, p. 4) that any report was made in reference to the matter of the improvement of the said river.

The next record appears in the river and harbor bill of June 18, 1878 (vol. 20, Stat. L., p. 153), which provides that—

"the Secretary of War is hereby directed at his discretion to cause examinations or surveys or both and estimates of the cost of improving the property to be made at the following points (p. 154): New River from the lead mines in Wythe County to the 'mouth of Wilson' in Grayson County, Va."

In the report of the Chief of Engineers of the Army for the year 1878 (Appendix F, p. 8) appears a synopsis of the plan of the improvement of New River, and on page 495 a full discussion of the said plan. The synopsis reports the adoption—

"of a plan for the improvement of this river, which contemplates a channel 30 feet wide and 2 feet deep below the lowest water, satisfactory for keel boats now in use, but at the same time capable of utilization and adaptation at some future time to a further improvement of the navigation and for light steamboats."

By river and harbor bill of June 14, 1880 (vol. 21, Stat. L., p. 180), there was appropriated for improving New River from the "mouth of Wilson" in Grayson County, Va., to the lead mines in Wythe County, the sum of $5,000, which is the first appropriation for the improvement of this section of New River.

3084-C In the report of the Chief of Engineers of the Army for the year 1879 (Appendix F, p. 530) is found a full statement of the topography of this section of New River, in which is included a report of the engineer in charge, from which the following is an extract:

"At present this portion of the river is not used at all for transportation purposes. Only the ordinary canoe is seen, and it is merely used for ferrying and fishing. For boat navigation a channel 2 feet deep and 30 feet wide, with tracking or towpaths at the falls and rapids will answer all purposes. Rock excavation, removing bowlders, stone and gravel, and building lateral dams will cost for the 62 miles $115,000."

In the report of the Chief of Engineers of the Army for the year 1881 (p. 905, Appendix G), Col. W. P. Smith reports as follows:

"For 5 miles above the lead mines the obstructions in the river are about the same as described elsewhere, then the fall becomes very rapid, as the mountains are here reached. These extend for 14 miles, which will necessarily make the work very heavy for that distance. As Fosters Falls, 37 miles above the New River Bridge, offers such an obstruction as to prevent the lead mines and furnaces above from shipping their products down the river, it is respectfully recommended that a careful survey be made of them with a view to their improvement by locks and dams. The fall is about 18 feet over slate and limestone ledges in 2,300 feet, with a short pool and a succession of ledges."

And on page 907 Col. Smith increases the estimate which was made for a 30-foot channel 2 feet deep, at $115,000, to a modified plan for a 20-foot channel 2 feet deep, at a cost of $205,000.

River and harbor bill of October 3, 1881, carried no appropriations for this section of the river.

From the report of the Chief of Engineers for the year 1882 the following extract is taken:

"The work covers a space of 5½ miles from the lead mines to Wilkinson's Forge, passing over eight shoals and ledges, with a fall of 49.26 feet in that distance. The original plan of improvement has been adhered to, except the width of the channels on the middle and upper divisions has been reduced to 20 feet and on the former to 10 feet."

It seems that this work was done during the year 1881, and nothing done during the year 1882.

River and harbor bill of August 2, 1882 (vol. 22 Stat. L., p. 191), appropriates $5,000 for the improvement of this section of the river.

Being without the report of the Chief of Engineers of the Army for the year 1883, and referring to his report for the year 1884, it appears that something like $11,000 was expended over that entire section of the river extending from Greenbrier River in West Virginia to the "mouth of Wilson," in Grayson County, Va.

No work was done by the department on this section of the river in 1884, and there remained an unexpended balance of $3,079 during the year 1885, $2,500 of which was expended on the next mile immediately above the 5¼-mile point above the lead mines referred to in the last quotation.

The river and harbor bill of August 5, 1886 (vol. 24, Stat. L., p. 310), carried an appropriation of $10,000 for this improvement.

In the report of the Chief of Engineers of the Army for the year 1887 the following appears:

"The portion of the river to which it (the appropriation) is applicable is above Foster's Falls, and these can only be passed by one or two locks, at a cost much greater than Congress is likely to authorize. There is also a strong reason for doubt whether, considering the present developments of that section of the country, the construction of such locks would be justifiable, even if the money were available. The construction of railroads near this stream has for the present very much diminished the importance of the improvements to the portion above Foster's Falls."

3084–D And in that report the report of Col. Craighill is cited, as follows:

"While there is much development in progress, and more in prospect for the country on and near this upper section, yet the recent examination of Col. Smith would seem to indicate that while the rafting of timber would be facilitated by expending the available $10,000 in the method suggested by him that kind of navigation is already practicable, and the expenditure of the money would not be advantageous to any important extent to navigation by push boats. Under all the circumstances it seems unnecessary to spend $10,000 on the upper New River in 1887, and it is accordingly recommended that the money be held in reserve." (See Appendix L, p. 1926.)

On page 1927 the report of Col. William Proctor Smith, assistant engineer, states:

"It is thought that the $10,000 now under consideration will make such a channel 20 feet wide and 2 feet deep as far as the Grayson Sulphur Springs, 6.8 miles above the Ivanhoe furnace, into the timber region. Anyhow it will make it as far as the

new mineral company's ferry at Cripple Creek, 5¾ miles above the initial point where timber can be had."

The point referred to is the Grayson Sulphur Springs, which it seems is the extreme distance over which the appropriations would *would* permit any improvement, and is between 6 and 7 miles below the point at which it is desired to erect a dam.

The report of the Chief of Engineers of the Army for the year 1888, after considering the report of Col. Smith cited above, says (Appendix M, p. 7):

"After a careful reexamination of the subject and a reconnoissance it was decided to postpone the expenditure of the appropriation until the will of Congress could be further ascertained."

And in the same appendix, page 1760, referring to the section of the river above the lead mines, Col. Craighill says:

"A doubt having arisen, in view of the changed condition of affairs on and near the river, as to the propriety of expending this appropriation at once, it was decided by proper authority to defer operations until the will of Congress could be ascertained."

From the report of the Chief of Engineers for the year 1889 (Appendix O, p. 1962) the following extract is taken:

"The shoals are composed of loose rock and gravel, and had filled up considerably since the formation of the project two years ago. * * * About 35 cubic yards of material was removed from these shoals and built into walls."

This appears to be all of the work that was done during that fiscal year.

From the report of the Chief of Engineers for the year 1890 it appears (Appendix P, p. 7) that—

"In 1885 there was a channel 2 feet deep and 20 feet wide from the Ivanhoe Furnace to within 600 feet of the head of Wilkinson's shoals and ledges, a distance of 3.9 miles. In 1889 this channel with the same width and depth was extended to the lower end of the approach to the gulf, a distance of 5 miles from the initial point, with four-tenths of a mile farther up the river partially improved. The amount expended during the year ending June 30, 1890, has been $6,394."

From the report of the Chief of Engineers of the Army for the year 1891 (Appendix Q, p. 2432), the following extract of Col. Craighill is taken:

"Here attention is called to the effect of the changed condition, which sometimes arises, and New River is a striking illustration of it. In a country rich in minerals and agricultural products a natural waterway may be of great value, especially if there be no competing railroads and the cost of its improvement be not

very great. In course of time competing railroads are
3084–E built, the topography being favorable. If the expense of the improvement of the river be great and the available money little, the railroads will take the business, and the river becomes comparatively unimportant. This has for several years been the situation in the New River section of the country, especially the upper portion.

"This condition seems to have been recognized by Congress, from the fact that there were no appropriations for New River in 1883, 1884, and 1885.

* * * * * * *

"There was also considerable reason for doubt whether, considering the present development of that section of the country, the construction of such locks (referring to Fosters Falls) would be justifiable, even if the money were available. The construction of railroads near this stream has diminished very much the importance of the improvements of the portion above Fosters Falls.

* * * * * * *

"In 1889, the channel, with the same width and depth (20 feet, and 2 feet), was extended to the lower end of the approach to the gulf, a distance of 5 miles from the initial point (lead mines), with four-tenths of a mile farther up the river partially improved. This is obviously a very local improvement, made almost entirely of rock, at a great expense, and in my opinion of no value whatever.

"No work was done in the calendar year 1890, and none has been possible as yet in the year 1891, the water being too high and too cold."

From the report of the Chief of Engineers of the Army for the year 1892, it appears that there was no work done during that fiscal year. It appears that no work was done during the year 1893.

His report for the year 1894 shows a balance of $2,341.79 on hand remaining from the appropriations made by Congress for the improvement of this section of the river, and in his report for the year 1897 (Appendix V, p. 2567), the report of Maj. Craighill states:

"Any further improvement of that portion of the stream was apparently unnecessary on account of the changed conditions"

and in his report for the year 1898 (Appendix W, p. XIV), the Chief of Engineers of the Army says:

"As conditions have changed in late years, the further improvement of that portion of the stream has been reported as entirely unnecessary, and the Secretary of War has decided not to expend the existing balance at present."

It is believed that this is the last report of the War Department referring to the section of New River above the lead mines in Wythe County and below the "Mouth of Wilson," in Grayson County, Va.

It will be seen that the original project for the improvement of this river had in contemplation character of navigation no more extensive than that which a channel 20 feet wide, and in places reduced to 10 feet wide, and 2 feet deep, could afford; and that this project was considered advisable in view of the conditions which existed in this section of the country at the time of its inception prior to the year 1876; which was a lack of any facilities whatever, other than those afforded by the river, for the transportation of ore and timber from this upper region down to where the railroad crossed the river. Since that time the Norfolk & Western Railroad has extended its lines up the bank of New River, past the points spoken of as lead mines, Fosters Falls, Ivanhoe Furnace, and Grayson Springs, and within 6 miles of the point where it is desired to erect a dam, and that this extension, in the opinion of the Chief of Engineers, removed the necessity for any further expenditure of money upon this section of the river.

The transportation facilities of the railroad, far surpassing those which it was intended to supply by the improvement of the river, have entirely removed the causes which prompted Congress to undertake a task so expensive and of such limited utility.

3084–F If the desired permission is granted and the dam and mills erected the railroad will, of necessity, be extended to that point, and since it was not contemplated by the Engineers of the Army or by Congress to make a continuous navigable waterway of this stream, but only to afford access by water to the railroad as it was then located, it will readily be seen that the primary cause has been removed, and if the plan were ever carried out it would be the expenditure of a large sum of money resulting in no practical benefit to anyone.

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
*Washington, May 5, 1900.*

Capt. H. F. HODGES,
*Corps of Engineers, Cincinnati, Ohio.*

CAPTAIN: The inclosed bill, H. R. No. 11281, Fifty-sixth Congress, first session, "A bill permitting building a dam across New River," is referred to you for report.

An early report from this office upon this bill is desired, and you are accordingly requested to report by telegraph whether

there are, in your judgment, any objections to the bill in its present form.

By command of Brig. Gen. Wilson.

Very respectfully, your obedient servant,

A. MACKENZIE,
*Lieutenant Colonel, Corps of Engineers.*

(H. R. 11281, Fifty-sixth Congress, first session)

A BILL PERMITTING BUILDING A DAM ACROSS NEW RIVER

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the consent of Congress is hereby granted to F. H. Fries and W. C. Ruffin, of the State of North Carolina, their successors and assigns, to erect, construct, and maintain across New River, in Grayson County, Virginia, at any point within two miles of the mouth of Stephens Creek, a dam and all other works necessarily incident thereto for water-power purposes: Provided, That the said F. H. Fries and W. C. Ruffin, their successors and assigns, shall make at their own expense such change and modification of the said dam as the Secretary of War may from time to time direct in the interests of the navigation of said river: Provided further, That ladders suitable for the passage of fish over the said dam shall be constructed and maintained by the said parties, their successors and assigns, as may from time to time be required by the United States Fish Commission: Provided further, That in case any litigation arises from the obstruction of the channel by the said dam, or works appurtenant thereto, that the same may be tried in the courts of the United States having proper jurisdiction.

SEC. 2. That this act shall become null and void unless the dam herein authorized shall be commenced within two years and completed within five years of the date hereof.

SEC. 3. That the right to alter, amend, or repeal this act is hereby expressly reserved.

(Memo.—The committee call referred to below was returned and is not now of record in this office.)

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
*Washington, May 8, 1900.*

Hon. ELIHU ROOT, *Secretary of War.*

SIR: I have the honor to return herewith a letter, dated the 5th instant, from the Committee on Interstate and Foreign Commerce of the House of Representatives, inclosing for the views of the War Department thereon H. R. 11281, Fifty-sixth Con-

ress, first session: "A bill permitting building a dam across New iver," and, in reply to its reference to this office, I beg to recom- end certain amendments to the bill indicated on a copy of the ame herewith submitted. As thus amended I know of no objec- ion to the passage of the bill by Congress, so far as navigation nterests are concerned.

Very respectfully, your obedient servant,

JOHN M. WILSON,
*Brig. Gen., Chief of Engineers, U. S. Army.*

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(Telegram)

CINCINNATI, OHIO, *May 9, 1900.*

CHIEF OF ENGINEERS, United States Army,
*Washington, D. C.:*

No objection known to passage in present form of H. R. 11281 uthorizing New River Dam.

HODGES, *Engineers.*

ENGINEER OFFICE, UNITED STATES ARMY,
*Cincinnati, Ohio, May 10, 1900.*

Brig. Gen. JOHN M. WILSON,
*Chief of Engineers, United States Army, Washington, D. C.*

GENERAL: I have the honor to state that, in reply to depart- nent letter of the 5th instant, directing telegraphic report on H. R. bill No. 11281, permitting building a dam across New River, I telegraphed the department yesterday as follows:

"No objection known to passage in present form of H. R. 11281 uthorizing New River dam."

Stephens Creek, in the vicinity of which the dam is to be built, s near the upper end of the part of New River covered by the roject for improvement and above the farthest point already eached by the work. It is not believed that any attempt will ver be made to carry the improvement so far upstream, opera- ions on the river having been suspended indefinitely.

There is no present or prospective navigation which would varrant any opposition to this dam, which, as I am informed, is lesired by the people of the locality.

Very respectfully, your obedient servant,

H. F. HODGES,
*Captain, Corps of Engineers.*

(Memo.—The committee call referred to below was returned nd is not on the records of this office.)

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
*Washington, May 29, 1900.*

3087 Hon. ELIHU ROOT, *Secretary of War.*

SIR: I have the honor to return herewith a letter, dated the 26th instant, from the Senate Committee on Commerce, inclosing for the views of the War Department thereon S. 4849, Fifty-sixth Congress, first session, "A bill permitting building a dam across New River," and, in reply to its reference to this office, I beg to state that I know of no objection to the passage of the bill by Congress, so far as navigation interests are concerned.

Very respectfully, your obedient servant,

JOHN M. WILSON,
*Brig. Gen., Chief of Engineers, U. S. Army.*

(S. 4849, Fifty-sixth Congress, first session)

A BILL PERMITTING BUILDING A DAM ACROSS NEW RIVER

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the consent of Congress is hereby granted to F. H. Fries and W. C. Ruffin, of the State of North Carolina, their successors and assigns, to erect, construct, and maintain across New River, in Grayson County, Virginia, at any point within two miles of the mouth of Stevens Creek, a dam and all other works necessarily incident thereto for water-power purposes: Provided, That the said F. H. Fries and W. C. Ruffin, their successors and assigns, shall make, at their own expense, such change and modification of the said dam as the Secretary of War may from time to time direct in the interests of the navigation of said river: Provided further, That ladders suitable for the passage of fish over the said dam shall be constructed and maintained by the said parties, their successors and assigns, as may from time to time be required by the United States Fish Commissioner: Provided further, That in case any litigation arises from the obstruction of the channel by the said dam, or works appurtenant thereto, that the same may be tried in the courts of the United States having proper jurisdiction.

SEC. 2. That this act shall become null and void unless the dam herein authorized shall be commenced within two years and completed within five years of the date hereof.

3088 SEC. 3. That the right to alter, amend, or repeal this act is hereby expressly reserved.

EXECUTIVE MANSION,
*Washington, June 2, 1900.*

MY DEAR SIR: The President directs me to submit the accompanying bills, H. R. 11281 and H. R. 9884, for your examination, with the request that you will inform him at the earliest practicable date whether you know of any objections to their approval.

Very truly yours,

GEO. B. CORTELYOU,
*Secretary to the President.*

Hon. ELIHU ROOT, *Secretary of War.*

(Second indorsement)

OFFICE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
*June 2, 1900.*

Respectfully returned to the Secretary of War.

I know of no objection to the approval by the President of the accompanying H. R. 11281, Fifty-sixth Congress, first session, "An act permitting building a dam across New River."

JOHN M. WILSON,
*Brigadier General, Chief of Engineers,*
*United States Army.*

WAR DEPARTMENT,
*Washington, D. C., June 2, 1900.*

The PRESIDENT:

In returning herewith House bill 11281, Fifty-sixth Congress, first session, being an act permitting building a dam across New River, I have the honor to state that there is no objection on the part of the department to the approval of the bill.

Very respectfully,

ELIHU ROOT, *Secretary of War.*

3089 OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
*Washington, December 20, 1901.*

Hon. ELIHU ROOT, *Secretary of War.*

SIR: I have the honor to return herewith a letter, dated the 17th instant, from the Senate Committee on Commerce, inclosing for the views of the War Department thereon S. 1719, Fifty-seventh Congress, first session, a bill permitting the building of a dam across New River.

This bill is identical with an act approved June 4, 1900, which is still in full force and effect, and the necessity for the passage of the bill is not apparent.

Section 2 of the aforesaid act provides that it shall become null and void unless the dam therein authorized shall be commenced

by June 4, 1902, and completed by June 4, 1905. It may be the intention of the proponent of the bill under consideration to provide for an extension of the time for the commencement and completion of the dam. If this is the object, it, in my opinion, will be better accomplished by a simple amendment to the original act.

Favorable consideration of the bill is not recommended.

Very respectfully, your obedient servant,

G. L. GILLESPIE,
*Brigadier General, Chief of Engineers,*
*United States Army.*

(Memo.—The above-mentioned call of committee was returned; is not now on file.)

(S. 1719, Fifty-seventh Congress, first session)

A BILL PERMITTING THE BUILDING OF A DAM ACROSS NEW RIVER

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the consent of Congress is hereby granted to F. H. Fries and W. C. Ruffin, of the State of North Carolina, their successors and assigns, to erect, construct, and maintain across New River, in Grayson County, Virginia, at any point within two miles of the mouth of Stevens Creek, a dam and all other works necessarily incident thereto for water-power purposes: Provided, That 3090 the said F. H. Fries and W. C. Ruffin, their successors and assigns, shall make, at their own expense, such change and modification of the said dam as the Secretary of War may from time to time direct in the interests of the navigation of said river: Provided further, That ladders suitable for the passage of fish over the said dam shall be constructed and maintained by the said parties, their successors and assigns, as may from time to time be required by the United States Fish Commissioner: Provided further, That in case any litigation arises from the obstruction of the channel by the said dam, or works appurtenant thereto, that the same may be tried in the courts of the United States having proper jurisdiction.

SEC. 2. That this act shall become null and void unless the dam herein authorized shall be commenced within two years and completed within five years of the date hereof.

SEC. 3. That the right to alter, amend, or repeal this act is hereby expressly reserved.

(Second indorsement)

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
*Washington, May 5, 1908.*

1. Respectfully returned to the Secretary of War, inviting attention to an amended draft of the bill which reaches the original purpose and also embodies certain instructions received by the Chief of Engineers.

2. It is recommended that the amended draft be transmitted to the committee with the approval of the War Department.

A. MACKENZIE,
*Brigadier General, Chief of Engineers,*
*United States Army.*

(Third indorsement)

WAR DEPARTMENT, *May 6, 1908.*

Respectfully returned to the chairman Committee on Commerce, United States Senate, inviting attention to the foregoing report of the Chief of Engineers, United States Army, and to the accompanying copy of amended bill referred to.

3091 The department concurs in the views of the Chief of Engineers.

ROBERT SHAW OLIVER,
*Acting Secretary of War.*

(Fourth indorsement)

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
*Washington, May 20, 1908.*

1. Respectfully returned to the Secretary of War.

2. The Chief of Engineers has no further suggestions to make and recommends that all papers be transmitted to the Senate Committee on Commerce.

A. MACKENZIE,
*Brigadier General, Chief of Engineers,*
*United States Army.*

(Memo.—The above-mentioned call of the committee was returned and is not now on file.)

A BILL PERMITTING THE BUILDING OF A DAM OR DAMS ACROSS NEW RIVER

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That J. J. Mott, a resident of Radford, in the State of Virginia, his heirs, executors, and assigns, be, and he is hereby, authorized to construct and maintain a dam or dams across the New River, extending from Burton Station, a point in Giles County on New River in said State, through Pulaski and Montgomery Counties in said State, to Hiwassa, on New River, Pulaski County, including Fall Branch Falls, Ingle Falls, Pepper Falls, Barretts Falls, and Dry Branch Falls, and all works incident thereto, in accordance with the provisions of an act entitled "An act to regulate the construction of dams across navigable waters," approved June first, nineteen hundred and six: Provided, That in acting upon plans for the structures herein authorized, consideration shall be given by the War Department to the bearing of the said structures upon a comprehensive plan for the improvement of the New River, and the full development of water power: And provided further, That the Secretary of War and the Chief of Engineers shall, in accordance with the aforesaid act of June twenty-first, nineteen hundred and six, as a part of the conditions and stipulations therein contemplated, provide for improving and developing navigation, and fix such charge or charges for the
3092 privilege granted as they deem necessary for the present and future interests of the United States, the proceeds of such charge or charges to be applied to the improvement of navigation: And provided further, That, in pursuance of the provisions of sections four and six of said act, the Secretary of War is authorized and directed, in case the grantees at any time fail to comply with any of the requirements of this act, or of the aforesaid act of June twenty-first, nineteen hundred and six, or with any of the stipulations or conditions prescribed in pursuance of these acts, to revoke the privileges herein granted and to declare the grant void, without prejudice to the equities of the grantee at the time of revocation, and in addition thereto, the right to revoke by act of Congress at any time after fifty years the rights, privileges, and benefits conferred by this act, is hereby expressly reserved, but in the event of such revocation by Congress, the United States shall pay to the owners of said dam and appurtenant works, as full compensation, the reasonable value thereof, exclusive of the value of the franchise hereby conferred, such reasonable value to be determined by mutual agreement between the Secretary of War and the owners of said

properties, and in case they can not agree, then by proceedings instituted in the United States Circuit Court for the condemnation of such properties.

SEC. 2. Unless extended by act of Congress, all the rights and privileges hereby conferred shall terminate at the end of ninety-nine years from the date of approval of this act, unless sooner revoked as hereinbefore provided, and in the event of such termination, unless renewed by Congress, payment shall be made in the manner and to the amount provided as aforesaid.

(Memo.—The committee call referred to below was returned and is not now on file.)

(Second indorsement)

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
*Washington, May 5, 1908.*

1. Respectfully returned to the Secretary of War, inviting attention to the accompanying draft of a bill which reaches the original purpose and also embodies certain instructions received by the Chief of Engineers.

3093 2. It is recommended that the amended draft be transmitted to the committee with the approval of the War Department.

———— ————,
*Brigadier General, Chief of Engineers,*
*U. S. Army.*

(Third indorsement)

WAR DEPARTMENT, *May 6, 1908.*

Respectfully returned to the chairman Committee on Interstate and Foreign Commerce, House of Representatives, inviting attention to the foregoing report of the Chief of Engineers, United States Army, and to the accompanying copy of amended bill referred to.

The department concurs in the views of the Chief of Engineers.

ROBERT SHAW OLIVER,
*Acting Secretary of War.*

(Fourth indorsement)

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
*Washington, May 20, 1908.*

1. Respectfully returned to the Secretary of War.

2. The Chief of Engineers has no further suggestions to make and recommends that all papers be transmitted to the Committee

on Interstate and Foreign Commerce of the House of Representatives.

A. MACKENZIE,
*Brigadier General, Chief of Engineers.*

(H. R. 20246, Sixtieth Congress, first session)

A BILL PERMITTING THE BUILDING OF A DAM OR DAMS ACROSS NEW RIVER, VIRGINIA

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That J. J. Mott, a resident of Radford, in the State of Virginia, his heirs, executors, and assigns, be, and he is hereby, authorized to construct and maintain a dam or dams across the New River, extending from Burton Station, a point in Giles County, on New River, in said State, through Pulaski and Montgomery Counties, in said State, to Hiwassa, on New River, Pulaski County, including Fall Branch Falls, Ingle Falls, Pepper Falls, Barretts Falls, and Dry Branch Falls, and all works incident thereto in accordance with the provisions of an act entitled "An act to regulate the construction of dams across navigable
3094 waters," approved June first, nineteen hundred and six: Provided, That in acting upon plans for the structures herein authorized, consideration shall be given by the War Department to the bearing of the said structures upon a comprehensive plan for the improvement of the New River and the full development of water power: And provided further, That the Secretary of War and the Chief of Engineers shall, in accordance with the aforesaid act of June twenty-first, nineteen hundred and six, as a part of the conditions and stipulations therein contemplated, provide for improving and developing navigation, and fix such charge or charges for the privilege granted as they may deem necessary for the present and future interests of the United States, the proceeds of such charge or charges to be applied to the improvement of navigation: And provided further, That, in pursuance of the provisions of sections four and six of said act, the Secretary of War is authorized and directed, in case the grantees at any time fail to comply with any of the requirements of this act, or of the aforesaid act of June twenty-first, nineteen hundred and six, or with any of the stipulations or conditions prescribed in pursuance of these acts, to revoke the privileges herein granted and to declare the grant void, without prejudice to the equities of the grantee at the time of revocation; and in addition thereto, the right to revoke by act of Congress at any time after fifty years the rights, privileges, and benefits conferred by this act, is hereby expressly reserved, but in the

event of such revocation by Congress, the United States shall pay to the owners of said dam and appurtenant works, as full compensation, the reasonable value thereof, exclusive of the value of the franchise hereby conferred, such reasonable value to be determined by mutual agreement between the Secretary of War and the owners of said properties, and in case they can not agree, then by proceedings instituted in the United States Circuit Court for the condemnation of such properties.

SEC. 2. Unless extended by act of Congress, all the rights and privileges hereby conferred shall terminate at the end of ninety-nine years from the date of approval of this act, unless sooner revoked as hereinbefore provided, and in the event of such termination, unless renewed by Congress, payment shall be made in the manner and to the amount provided as aforesaid.

3095

UNITED STATES ENGINEER OFFICE,
*Wheeling, W. Va., April 18, 1908.*

Brig. Gen. A. MACKENZIE,
*Chief of Engineers, United States Army, Washington, D. C.*

GENERAL: 1. I have the honor to submit the following report in compliance with first indorsement on E. D. 67022.

2. The smallest known discharge of the New River at the point referred to is about 700 cubic feet per second. The minimum discharge available for eight months of the year is about 1,880 cubic feet per second. Assuming an efficiency of 78 percent for the wheels and no allowance for locking or leakage, there would be about 167 horsepower available for eight months and a minimum of 62 horsepower during the remaining months for each foot of head.

3. There are a number of falls in this part of the river, ranging up to about 8 feet in height, and the general slope of the river is about 4½ feet per mile. No estimate of the actual horsepower is possible without some knowledge of the number and height of the proposed dams.

Very respectfully,

F. W. ALTSTAETTER,
*Captain, Corps of Engineers.*

(S: 6409 Sixtieth Congress, first session)

A BILL PERMITTING THE BUILDING OF A DAM OR DAMS ACROSS NEW RIVER

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That J. J. Mott, a resident of Radford, in the State of Virginia, his heirs,

executors, and assigns, is hereby authorized to construct and maintain a dam or dams across the New River, extending from Burton Station, a point in Giles County on New River in said State, through Pulaski and Montgomery Counties in said State, to Hiwassa, on New River, Pulaski County, including Fall Branch Falls, Ingle Falls, Pepper Falls, Barretts Falls, and Dry Branch Falls, and all works incident thereto, including deflection of water from main channel and return to the channel where desired in the utilization of the power to be thereby developed, in accordance with the provisions of an act entitled "An act to regulate the construction of dams across navigable waters," 3096 approved June first, nineteen hundred and six.

HOUSE OF REPRESENTATIVES,
*Washington, D. C., March 26, 1912.*

SECRETARY OF WAR, *Washington, D. C.*

DEAR SIR: I would like to know whether the records of your department show if during the present administration, or any prior administration, the right to dam New River was given to one Dr. Mott, or the Appalachian Power Co., or to any other person.

New River runs into my district, and certain large dams are now being constructed thereon. I understand that it is claimed on the part of the persons constructing these dams that they have some sort of license, or permit, from the Secretary of War.

Some years ago a bill was introduced in Congress for the purpose of giving Dr. Mott the exclusive right to dam New River between Burton in Giles County, to Hiawassie, in Pulaski, but this bill was defeated in the committee.

Any information along the above line will be appreciated.

Yours very truly,

E. W. SAUNDERS.

(Second indorsement)

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
*Washington, April 1, 1912.*

1. Respectfully returned to the Secretary of War.

2. It does not appear from the records of this office that authority has been granted by Congress for the construction of a dam in New River, Va., by Dr. Mott or the Appalachian Power Co.

3. By acts of Congress, approved June 4, 1900 (34 Stats. L., 264), authority was granted F. H. Frees and W. C. Ruffin to

construct a dam across New River in Grayson County, Va., and by acts approved February 28, 1911, authority was granted the Virginia Iron, Coal & Coke Co. (36 Stats. L., 921) and the Ivanhoe Furnace Corporation (36 Stats. L., 992), to erect dams near Fosters Falls and at Ivanhoe, Wythe County, Va., respectively.

3097 4. I recommend that Mr. Saunders be so informed with the further information that since New River is an interstate stream, the authority of Congress must, under the law, be obtained for construction of a dam therein, and that the plans therefor must receive the approval of the Chief of Engineers and Secretary of War before the work of construction is begun, but such approval has not been obtained in the cases mentioned.

W. H. BIXBY,
*Chief of Engineers, United States Army.*

WAR DEPARTMENT,
*Washington, April 4, 1912.*

DEAR SIR: Referring to your letter of 26th ultimo, asking to be advised whether War Department records show that Dr. Mott or the Appalachian Power Co. have ever secured permission to dam New River, Va., I beg to inform you that the Chief of Engineers, United States Army, to whom the matter was referred, reports under date of 1st instant as follows:

"By acts of Congress approved June 4, 1900 (34 Stats. L., 264), authority was granted F. H. Frees and W. C. Ruffin to construct a dam across New River in Grayson County, Va., and by acts approved February 28, 1911, authority was granted the Virginia Iron, Coal & Coke Co. (36 Stats. L. 921), and the Ivanhoe Furnace Corporation (36 Stats. L., 922), to erect dams near Fosters Falls and at Ivanhoe, Wythe County, Va., respectively."

As New River is an interstate stream, the authority of Congress must, under the law, be obtained for the construction of a dam therein, and plans therefor must receive the approval of the Chief of Engineers, United States Army, and the Secretary of War before any work of construction is begun. Such approval has not been obtained in either of the cases above referred to Dr. Mott or the Appalachian Power Co.

Very respectfully,

ROBERT SHAW OLIVER,
*Assistant Secretary of War.*

Hon. E. W. SAUNDERS,
*House of Representatives.*

3098

WAR DEPARTMENT,
UNITED STATES ENGINEER OFFICE,
*Wheeling, W. Va., November 23, 1912.*

From: Maj. F. W. Altstaetter, Corps of Engineers, U. S. A.
To: The Chief of Engineers, U. S. Army, Washington, D. C.
Subject: Water-power dams, New River.

1. In the laws of the United States relating to the improvement of rivers and harbors, published in 1907 at the Government Printing Office, in volume 2, page 909, is an act authorizing the construction of a dam across the New River, with the requirement that the dam should be built within five years. There is nothing on record in this office to indicate that there was ever any correspondence with the Chief of Engineers concerning this act.

2. In 1908 a bill for water-power dam on the upper New River was passed and referred by the Chief of Engineers to this office for remark, in first indorsement dated March 4, 1908 (E. D. 67022). This office made a few remarks about the amount of water power available, after which there was no further correspondence with the Chief of Engineers in the matter.

3. A third bill was passed authorizing a dam across the upper New River, and was referred by the Chief of Engineers to this office for report, in first indorsement dated June 7, 1910 (E. D. 76394), after which there was no further correspondence with the department.

4. There is an Appalachian Power Co. which has the project for six power dams in this upper river, two of which are already completed.

5. This office is exercising no form of supervision over any of these dams; nor is it known whether any other office is doing so. It is quite possible that no supervision is required by this or any other district office, but it was thought best to call the attention of the Chief of Engineers to the matter.

F. W. ALTSTAETTER.

(First indorsement)

OFFICE CHIEF OF ENGINEERS,
*December 5, 1912.*

To Maj. ALTSTAETTER:

1. It appears from the records of this office that the only acts authorizing the construction of dams across New River, Va.
3099 and W. Va., are one approved June 4, 1900, authorizing the erection of such structures by F. H. Fries and W. G. Ruffin, and two approved February 18, 1911, giving similar privilege to the Ivanhoe Furnace Corporation and to the Virginia Iron, Coal & Coke Co.

2. Plans for these dams have not been submitted to nor received the approval of the department, nor have they been for any other similar structures. By reference to the aforesaid act of June 4, 1900, it will be noted that no duty in connection with the original plans appears to have been committed to the department, but it is considered that under the provisions of section 9 of the river and harbor act of March 3, 1899, approval of the plans should have been obtained from the department prior to beginning the work of construction.

3. The act of June 4, 1900, expired by limitation on June 4, 1905, and any dam built under authority thereof prior to the latter date would be illegal for the reason that plans were not presented to and approved by the department in accordance with section 8 of the act of March 3, 1899. Any dam built subsequent to June 4, 1905, would, of course, be illegal for the same reason and for the additional reason that the act of authorization had become null and void.

4. The two acts approved February 18, 1911, provide that the dams shall be constructed, maintained, and operated in accordance with the general dam act of June 23, 1910, which requires the submission of plans to the department for examination and approval, and also fixes a time limit of one year for commencing the structures. These acts have, therefore, apparently expired by limitation, and any structures built thereover would be unlawful for the reasons above stated.

5. It is not known whether the project of the Appalachian Power Co., to which Maj. Altstaetter refers, has any relation to the aforesaid acts, but if it has, its prosecution is clearly without authority of law. It may be that this company is proceeding on the theory that the upper river being unnavigable the consent of Congress for the building of its projected dams is not required.

This, of course, is a question that would ultimately
3100 require judicial determination, and the legal right of this company would depend upon the facts as to whether the dams interfered with navigation or injuriously affected the navigable condition or capacity of the stream.

6. In the absence of approval by the department on plans for the structures no duty in connection with supervision of construction would be assigned to the district officer; but when operations of this character are known by the district officer to be in progress, he should make a careful investigation with a view to ascertaining all the facts and of deciding whether action against the company should be instituted.

By order of the Acting Chief of Engineers.

E. N. JOHNSTON,
*Captain, Corps of Engineers.*

(Second indorsement)

UNITED STATES ENGINEER OFFICE,
*Wheeling, W. Va., March 7, 1913.*

To the CHIEF OF ENGINEERS, United States Army.

1. This office has had some correspondence with the Appalachian Power Co. since the above letter was written, and I have had a conference with one of their representatives. While very courteous in their dealings with this office, this company seems desirous of taking up the matter in Washington. A recent letter from this company to this office contains the following:

"Because the basic principles as to which there is contention have country wide application and affect other properties, this matter has been taken up congressionally and with the Office of Chief Engineers, United States Army, our representative being Gen. Geo. H. Harries, vice president of H. M. Byllesby & Co.

"Gen. Harries (who has just returned from Washington), informs me that consideration is now being given to a suggestion that by friendly litigation, carried to the Supreme Court of the United States, there be secured a definite judicial determination of all the questions at issue. This procedure is essential because there are now no decisions sufficiently definite to afford sure guidance either to the Government or the investor."

2. It is assumed that this matter for the present is being handled by the department direct, and no further action will be taken by this office in this case unless further instructions are received.

F. W. ALTSTAETTER,
*Major, Corps of Engineers.*

3101 (Third indorsement)

OFFICE CHIEF OF ENGINEERS,
*March 22, 1913.*

To Maj. ALTSTAETTER.

1. The matter referred to in second indorsement hereon has not been taken up with the department by the company except in an informal way.

2. The only way to get it before the Supreme Court is to take action on some concrete case, and action in accordance with the instructions in first indorsement hereon should be taken regardless of any statement made to the district officer by the company.

By command of the Chief of Engineers.

E. N. JOHNSTON,
*Captain, Corps of Engineers.*

(House of Representatives, Committee on Accounts, Washington)

HUNTINGTON, W. VA., *August 10, 1908.*

SECRETARY OF WAR, *Washington, D. C.*

SIR: I inclose you letter from H. F. Staley, at Bluefield, W. Va. I will be glad if you can give him the information asked for in this letter, and return me this letter when you have done so.

Very truly yours,

J. A. HUGHES.

(Inclosure returned and not on file.)

(Second indorsement)

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
*Washington, August 26, 1908.*

1. Respectfully returned to the Secretary of War.

2. New River being a navigable water not wholly within the limits of a single State, authority to construct a dam across the navigable portions thereof must be obtained from Congress and the plans and location of the structure approved by the Chief of Engineers and the Secretary of War before construction is begun, as required by the provisions of section 9 of the river and harbor act of March 3, 1899.

3. The provisions of this section of law apply to the portion of the river in the vicinity of Lurich.

3102 4. I recommend that Mr. Hughes be so advised for the information of his correspondent, and that the inclosure be returned as requested within.

W. L. MARSHALL,
*Brig. Gen., Chief of Engineers,*
*United States Army.*

WAR DEPARTMENT,
*Washington, August 29, 1908.*

DEAR SIR: I have the honor to acknowledge the receipt of your letter of the 10th instant, inclosing a communication addressed to you by Mr. H. F. Staley, of Bluefield, W. Va., requesting information regarding the water rights of New River, from Lurich about 2 miles downstream; also with reference to damming said river for the purpose of securing power.

Replying thereto I beg to inform you that New River being a navigable water not wholly within the limits of a single State the authority to construct a dam across the navigable portions thereof must be obtained from Congress and the plans and location of the structure approved by the Chief of Engineers, United States Army, and the Secretary of War before construction is

begun, as required by the provisions of section 9 of the river and harbor act of March 3, 1899. The provisions of this section of the law apply to that portion of the river in the vicinity of Lurich.

The letter of your correspondent is returned herewith, as requested.

Very respectfully,

LUKE E. WRIGHT,
*Secretary of War.*

Hon. J. A. HUGHES,
*Huntington, W. Va.*

GRAHAM, VA., *December 12, 1910.*

MR. FRANK PIERCE,
*Acting Secretary, Department of the Interior,*
*Washington, D. C.*

DEAR SIR: Please accept my thanks for your favor of November 30, in reference to the New River water power, with papers of the Geological Survey.

My object in writing was chiefly to learn the Govern-
3103 ment's attitude in such matters, supposing the New River to be under Government control, and the requirements to be met in obtaining the right to develop a water-power plant on New River.

Will you please inform me as fully as possible the requirements of the Government in this connection, and oblige,

Yours, respectfully,

WALTER GRAHAM.

DEPARTMENT OF THE INTERIOR,
*Washington, December 15, 1910.*

MR. WALTER GRAHAM, *Graham, Va.*

DEAR SIR: In reply to your letter of December 12:

The Interior Department has no control over streams outside of the public land States. I am therefore unable to furnish the information desired in regard to New River.

The Chief of Engineers, United States Army, has control over the navigable rivers of the country and if the portion of New River in which you are interested has been designated as navigable, it would come under his jurisdiction. Your letter has been referred to the Chief of Engineers for reply.

Very respectfully,

R. A. BALLINGER, *Secretary.*

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
*Washington, December 20, 1910.*

Mr. WALTER GRAHAM, *Graham, Va.*

SIR: 1. Your letter of the 12th instant addressed to the Secretary of the Department of the Interior, in reference to construction of a water-power plant on New River, Va., has been referred to this office for reply.

2. There is inclosed herewith for your information a pamphlet of laws enacted by Congress for the preservation and pro-
3104 tection of navigable waters, your attention being invited to section 9 of the river and harbor act of March 3, 1899, also to the accompanying copy of a general dam act approved June 23, 1910. There is also inclosed a rule of the department to be observed by parties making application for approval of plans for a bridge, which is applicable to similar requests relating to dams except that the plans for such structures should be submitted in quadruplicate instead of in triplicate.

By direction of the Chief of Engineers.

Very respectfully,

E. N. JOHNSTON,
*Captain, Corps of Engineers.*

(Second indorsement)

WAR DEPARTMENT, CHIEF OF ENGINEERS,
*Washington, January 13, 1910.*

1. Respectfully returned to Mr. Hill, inviting attention to section 9 of the river and harbor act of March 3, 1899, printed in the accompanying pamphlet, relative to constructing dams over navigable waters; also to a copy of a general dam act enacted by Congress and approved June 21, 1906.

2. There is also inclosed for your information a rule of the department, to be observed by parties making application for approval of plans for a bridge, which is applicable to similar requests relating to dams, except that the plans for such structures should be submitted in quadruplicate instead of triplicate.

By direction of the Chief of Engineers.

J. B. CAVANAUGH,
*Major, Corps of Engineers.*

(Above letter of Mr. Geo. H. Hill returned and not now on file.)

(Second indorsement)

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
*Washington, January 19, 1910.*

1. Respectfully returned to the Secretary of War.

2. The accompanying bill, H. R. 17848, Sixty-first Congress, second session, to authorize the construction of a dam across New River near Foster Falls, Wythe County, Va., is in
3105 the usual form, and its provisions are believed to be satisfactory so far as the interests of navigation are concerned.

3. At the location named in the bill, New River is capable of little navigation, and its future improvement is not likely to be attempted by the United States. While surveys have been made, and some portions of the river have been improved by authority of Congress, operations were indefinitely suspended many years ago, and there is no present or prospective navigation that would be injured by the passage of the bill.

4. As the question of fixing a time limit and exacting the payment of a royalty to the United States for the exercise of a privilege of this kind has been extensively considered by Congress during recent sessions, it is deemed appropriate to invite attention to the fact that provision is not made for these requirements in this bill, and it is understood that provision for imposing such requirements is not contained in the general dam act of June 21, 1906. Without venturing any opinion on the merits of the proposition or the propriety of its adoption, I beg to suggest that if Congress considers such requirements desirable they should be provided for in express terms in the bill, or appropriate amendment should be made to the aforesaid general dam act.

W. L. MARSHALL,
*Chief of Engineers, United States Army.*

(The call of committee referred to herein returned and not on file.)

(H. R. 17848, Sixty-first Congress, second session)

A BILL TO AUTHORIZE THE VIRGINIA IRON, COAL AND COKE COMPANY TO BUILD A DAM ACROSS THE NEW RIVER NEAR FOSTER FALLS, WYTHE COUNTY, VIRGINIA

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the Virginia Iron, Coal and Coke Company, a corporation organized under the laws of the State of Virginia, its successors and assigns, be, and they are hereby, authorized to construct, main-

tain, and operate a dam across the New River at a point near Foster Falls, Wythe County, in the State of Virginia, in accordance with the provisions of the Act entitled "An Act to regulate the construction of dams across navigable waters," ap-
3106 proved June twenty-first, nineteen hundred and six: Provided, That the actual construction of said dam shall be begun within two years and completed within five years from the date of the passage of this Act.

SEC. 2. That the right to alter, amend, or repeal this Act is hereby expressly reserved.

(Second indorsement)

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
*Washington, January 19. 1910.*

1. Respectfully returned to the Secretary of War.

2. The accompanying bill, S. 5248, Sixty-first Congress, second session, to authorize the construction of a dam across New River near Foster Falls, Wythe County, Va., is in the usual form, and its provisions are believed to be satisfactory so far as the interests of navigation are concerned.

3. At the location named in the bill, New River is capable of little navigation, and its future improvement is not likely to be attempted by the United States. While surveys have been made, and some portions of the river have been improved by authority of Congress, operations were indefinitely suspended many years ago, and there is no present or prospective navigation that would be injured by the passage of the bill.

4. As the question of fixing a time limit and exacting the payment of a royalty to the United States for the exercise of a privilége of this kind has been extensively considered by Congress during recent sessions, it is deemed appropriate to invite attention to the fact that provision is not made for these requirements in this bill, and it is understood that provision for imposing such requirements is not contained in the general dam act of June 21, 1906. Without venturing any opinion on the merits of the proposition or the propriety of its adoption, I beg to suggest that if Congress considers such requirements desirable they should be provided for in express terms in the bill, or appropriate amendment should be made to the aforesaid general dam act.

W. L. MARSHALL,
*Chief of Engineers, U. S. Army.*

(The above-mentioned call of committee was returned and is not on file.)

3107 (S. 5248, Sixty-first Congress, second session)

A BILL TO AUTHORIZE THE VIRGINIA IRON, COAL AND COKE COMPANY TO BUILD A DAM ACROSS NEW RIVER NEAR FOSTER FALLS, VIRGINIA.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the Virginia Iron, Coal and Coke Company, a corporation organized under the laws of the State of Virginia, its successors and assigns, be, and they are hereby, authorized to construct, maintain, and operate a dam across the New River at a point near Foster Falls, Wythe County, in the State of Virginia, in accordance with the provisions of the act entitled "An act to regulate the construction of dams across navigable waters," approved June twenty-first, nineteen hundred and six: Provided, That the actual construction of said dam shall be begun within two years and completed within five years from the date of the passage of this act.

SEC. 2. That the right to alter, amend, or repeal this act is hereby expressly reserved.

(Second indorsement)

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
*Washington, February 11, 1911.*

1. Respectfully returned to the Secretary of War.

2. The accompanying bill, S. 10676, Sixty-first Congress, third session, to authorize the construction of a dam across New River, near Foster Falls, Va., is similar to a bill, S. 5248, Sixty-first Congress, second session, concerning which I had the honor to make report under date of January 19, 1910.

3. At the location named in the bill, New River is capable of little navigation, and its future improvement is not likely to be attempted by the United States. While surveys have been made, and some portions of the river have been improved by authority of Congress, operations were suspended many years ago, and there is no present or prospective navigation that would be injured by the passage of this bill.

4. Moreover, the measure provides that the dam shall be built in accordance with the provisions of the general dam act of
3108 June 23, 1910, and as that act is understood to contain all the provisions considered by Congress and the Executive necessary to safeguard navigation and other interests of the United

States, I see no objection to favorable consideration of the bill by Congress.

W. H. BIXBY,
*Chief of Engineers, United States Army.*

(Memo.—The committee call referred to above was returned and is not now on file.)

(S. 10676, Sixty-first Congress, third session)

A BILL TO AUTHORIZE THE VIRGINIA IRON, COAL AND COKE COMPANY TO BUILD A DAM ACROSS THE NEW RIVER, NEAR FOSTER FALLS, WYTHE COUNTY, VIRGINIA.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the Virginia Iron, Coal and Coke Company, a corporation organized under the laws of the State of Virginia, its successors and assigns, be, and they are hereby, authorized to construct, maintain, and operate a dam across the New River, at a point suitable to the interests of navigation, at a point near Foster Falls, Wythe County, in the State of Virginia, in accordance with the provisions of the act approved June twenty-third, nineteen hundred and ten, entitled "An act to amend an act entitled, 'An act to regulate the construction of dams across navigable waters,' approved June twenty-first, nineteen hundred and six."

SEC. 2. That the right to alter, amend, or repeal this act is hereby expressly reserved.

(Second indorsement)

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
*Washington, February 18, 1911.*

1. Respectfully returned to the Secretary of War.

2. I know of no objection to the President's approval of the accompanying H. R. 31922, Sixty-first Congress, third session, "An act to authorize the Virginia Iron, Coal & Coke Co. to build a dam across the New River, near Foster Falls, Wythe County, Va."

W. H. BIXBY,
*Chief of Engineers, United States Army.*

3109

WAR DEPARTMENT,
*Washington, February 18, 1911.*

The PRESIDENT:

In returning herewith H. R. 31922, Sixty-first Congress, third session, being an act to authorize the Virginia Iron, Coal & Coke Co. to build a dam across the New River near Foster Falls, Wythe County, Va., I have the honor to state that there is no objection on the part of this department to the approval of the act.

Very respectfully,

J. M. DICKINSON,
*Secretary of War.*

(Memo.—The call of committee referred to below was returned and is not on file.)

(Second indorsement)

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
*Washington, June 18, 1910.*

1. Respectfully returned to the Secretary of War.

2. The object of the accompanying bill H. R. 26411 is to authorize the construction of a dam across New River at Ivanhoe, Va., a point where the river is not navigable.

3. So far as the interests of commerce, present or prospective, are concerned, I know of no objection to favorable consideration of the bill by Congress; but I suggest that it be amended to conform to the usual form which Congress has adopted for such measures. The suggested amendments have been indicated in red on the bill.

W. H. BIXBY,
*Chief of Engineers, United States Army.*

(H. R. 26411, Sixty-first Congress, second session)

A BILL AUTHORIZING THE IVANHOE FURNACE CORPORATION, OF IVANHOE, WYTHE COUNTY, VIRGINIA, TO ERECT A DAM ACROSS NEW RIVER

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the Ivanhoe Furnace Corporation, of Ivanhoe, Wythe County, Virginia, be, and hereby is, authorized to construct and maintain a dam across New River at Ivanhoe, Wythe County, Virginia, in accordance with the provisions of an act entitled "An act

3110 to regulate the construction of dams across navigable waters" approved June twenty-first, nineteen hundred and six.

SEC. 2. That the right to alter, amend, or repeal this act is hereby expressly reserved.

(First indorsement)

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
*Washington, June 7, 1910.*

Respectfully referred to Capt. F. W. Altstaetter, Corps of Engineers, for early report.

By command of the Chief of Engineers:

E. N. JOHNSTON,
*Captain, Corps of Engineers.*

(Second indorsement)

UNITED STATES ENGINEER OFFICE,
*Wheeling, W. Va., June 13, 1910.*

1. Respectfully returned to the Chief of Engineers, United States Army.

2. So far as is known to this office, the Government has never made any improvement on the New River above Ivanhoe, nor is there any commerce on that part of the river. It is, in fact, in the nature of a mountainous stream in that vicinity and would be difficult to make navigable for any depth.

3. I am informed that there is a fixed dam at Fries, 18 miles up the New River from Ivanhoe.

4. I do not know of any valid objection to building a dam at Ivanhoe, as provided in the bill herewith.

F. W. ALTSTAETTER,
*Captain, Corps of Engineers.*

(Second indorsement)

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
*Washington, February 18, 1911.*

1. Respectfully returned to the Secretary of War.

2. I know of no objection to the President's approval of the accompanying H. R. 31931, Sixty-first Congress, third ses-
3111 sion—"An act authorizing the Ivanhoe Furnace Corporation, of Ivanhoe, Wythe County, Va., to erect a dam across New River."

W. H. BIXBY,
*Chief of Engineers, United States Army.*

WAR DEPARTMENT,
*Washington, February 18, 1911.*

The PRESIDENT:

In returning herewith H. R. 31931, Sixty-first Congress, third session, being an act authorizing the Ivanhoe Furnace Corporation, of Ivanhoe, Wythe County, Va., to erect a dam across New River, I have the honor to state that there is no objection on the part of this department to the approval of the act.

Very respectfully,

J. M. DICKINSON,
*Secretary of War.*

3112 *Government exhibit No. 48*

1930—January 24, 1930, to March 11, 1930—"Kanawha River at Kanawha Falls, West Virginia"—automatic gage recorder chart. (Original Exhibit.)

*Government exhibit No. 49*

1930—March 11, 1930 to April 5, 1930—"Kanawha River at Kanawha Falls, West Virginia"—automatic gage recorder chart. (Original Exhibit.)

*Government exhibit No. 50*

1930—January 25, 1930, to March 10, 1930"—New River at Caperton, W. Va."—automatic gage recorder chart. (Original Exhibit.)

*Government exhibit No. 51*

1930—March 12, 1930 to April 4, 1930—"New River at Caperton, W. Va."—automatic gage recorder chart. (Original Exhibit.)

*Government exhibit No. 52*

1929–1936—"Rating Curve for Kanawha River at Kanawha Falls, W. Va." (Original Exhibit.)

*Government exhibit No. 53*

1929–1931—"Rating Curve for New River at Caperton, W. Va., (Original Exhibit.)

*Government exhibit No. 54*

1929–1934—"Rating Curve for New River at Hinton, West Virginia." (Original Exhibit.)

*Government exhibit No. 55*

October 27, 1928 to September 30, 1931—"Rating table for Kanawha River at Kanawha Falls, W. Va." (Original Exhibit.)

*Government exhibit No. 56*

November 20, 1928 to September 30, 1930—"Rating table for New River at Caperton, West Virginia." (Original Exhibit.)

3113 *Government exhibit No. 57*

4 sheets constituting "Rating tables for New River near Hinton, W. Va." for the following periods: October 1, 1929 to Sept. 30, 1934; December 1, 1923 to Sept. 30, 1929; December 1, 1923 to ———; December 1, 1923 to ———. (Original Exhibit.)

*Government exhibit No. 58*

March 15, 1930—"Water Records at Glen Lyn for the week ending Saturday, March 15, 1930." (Original Exhibit.)

*Government exhibit No. 59*

1930—"Water Records at Glen Lyn for week ending Saturday, March 22, 1930." (Original Exhibit.)

*Government exhibit No. 60*

1930—Water records at Glen Lyn for week ending March 29, 1930. (Original Exhibit.)

*Government exhibit No. 61*

1930—"Water records at Glen Lyn for week ending April 1, 1930." (Original Exhibit.)

*Government exhibit No. 62*

1930—Chart "New River at Eggleston, Va., March 11 to March 31, 1930." (Original Exhibit.)

*Government exhibit No. 63*

1930—Chart "New River at damsite "A" at Radford for the period from March 10, 1930 to April 1, 1930." (Original Exhibit.)

*Government exhibit No. 64*

1930—Chart "New River at Allisonia, March 11 to April 1, 1930." (Original Exhibit.)

*Government exhibit No. 65*

1930—Chart "New River at Ivanhoe from March 11 to April 1, 1930." (Original Exhibit.)

3114 *Government exhibit No. 66*

5 pages, containing rating curves for (a) Glen Lyn 1927–1928; (b) Eggleston 1911–24, 1925–28; (c) Dam site "A"; (d) Allisonia, 1930; (e) Ivanhoe, 1928–1930. (Original Exhibit.)

*Government exhibit No. 67*

5 sheets containing rating tables for New River at Glen Lyn, 1927–1928; Eggleston, Oct. 1, 1920 to Sept. 30, 1931; Dam Site "A" 1927–1929; Allisonia, 1930; Ivanhoe, 1928–1930. (Original Exhibit.)

*Government exhibits Nos. 68 to 83 inc.*

Water Supply Papers of United States Geological Survey. (Original Exhibits.)

*Government exhibit No. 84*

Daily discharges for year ending September 30, 1935 at the gaging station on New River at Ivanhoe, Virginia. (Original Exhibit.)

*Government exhibit No. 85*

Daily discharges for the year ending Sept. 30, 1935 at the gaging station on New River at Allisonia, Va. (Original Exhibit.)

*Government exhibit No. 86*

Daily discharges for the year ending Sept. 30, 1935 at the gaging station on New River at Eggleston, Va. (Original Exhibit.)

*Government exhibit No. 87*

Daily discharges for the year ending Sept. 30, 1935 at the gaging station on Little River at Graysonton, Va. (Original Exhibit.)

3115 *Government exhibit No. 88.*

DECLARATION OF INTENTION TO CONSTRUCT A DAM AND OTHER PROJECT WORKS

Curtis, Mallet-Prevost, Colt & Mosle, Counsellors at Law, 30 Broad Street, New York

3116 NEW RIVER DEVELOPMENT COMPANY,
31 NASSAU STREET,
*New York, June 25, 1925.*

DECLARATION OF INTENTION TO CONSTRUCT A DAM AND OTHER PROJECT WORKS

New River Development Company, a public service corporation organized and existing under and by virtue of Chapter 150 of the Code of Virginia, intending to construct a dam and other project works across, along, over and in New River in the County of Pulaski, State of Virginia, hereby makes and files declaration of its intention so to do, pursuant to the provisions of Section 23 of the Federal Water Power Act and respectfully requests the Federal Power Commission to cause an immediate investigation of such proposed construction to be made.

In compliance with Regulation 7 of the Regulations of the Federal Power Commission, this Declaration of Intention is accompanied by exhibits which are hereby referred to and made a part hereof, as follows:

Exhibit A: Sketch maps showing the stream to be utilized and the approximate location of the project, as follows:

1. Map of Viele, Blackwell & Buck, Engineers, No. A–6836, showing general location of Project on New River;

2. Map of Viele, Blackwell & Buck, Engineers, No. R–7652, showing portion of river immediately affected by Project;

3. Map of Viele, Blackwell & Buck, Engineers, No. R–7656, showing general plan of proposed development.

Exhibit B: A brief description of the Project and its purpose,
3117 including data with respect to proposed height of dam, storage capacity of reservoir, power capacity of the Project and probable effect on present or prospective navigation;

Exhibit C: A statement as to whether, if the Commission finds that the Project will affect the interests of interstate or foreign commerce, the applicant proposes to apply for a permit or a license.

In witness whereof the applicant has caused its corporate name to be hereunto affixed by George N. Tidd, its Vice-President, and its corporate seal to be hereunto affixed and attested by Frank B. Ball, its Secretary, thereunto duly authorized this 25th day of June 1925.

NEW RIVER DEVELOPMENT COMPANY,
By GEO. N. TIDD, *Vice-President.*

Attest:
[SEAL] FRANK B. BALL, *Secretary.*

3118 Exhibit B

DESCRIPTION OF PROJECT OF NEW RIVER DEVELOPMENT COMPANY IN NEW RIVER, VIRGINIA

Under this Project it is proposed to develop for the purpose of generating hydro-electric power the fall in New River from the Norfolk & Western Railroad bridge at Hiawassia, Virginia, to a point near the mouth of Little River, a distance of approximately 20 miles with a fall of 110 feet. The dam is to be located about one mile above Little River or approximately seven miles above the town of East Radford. The development will be formed by a dam across the New River, with the power house in front of the dam fed by short steel penstocks. The dam will be constructed of Cyclopean concrete on solid rock foundations and abutment, and provided with ample flood gates and spillway.

The principal elevations and data pertaining to the project are as follows:

| | |
|---|---|
| Drainage area | 2396 sq. mi. |
| Water surface at dam site | El. 1730 ±. |
| High water over dam | El. 1841. |
| Top of retaining section and intake | El. 1850. |
| Top of flood gates and flashboards | El. 1840. |
| Sill of flood gates | El. 1810. |
| Crest of Spillway | El. 1835. |
| Height of Spillway section at deepest point | 115 ft. |
| Height of intake section at deepest point | 128 ft. |
| Pond formed by dam about | 4,000 acres. |
| Storage with 10 ft. draft, about | 40,000 acre ft. |
| Installed capacity | 60,000 KW or 80,000 HP. |
| Yearly output | 200,000,000 KWH ±. |

Eighty percent of all lands and water rights required for the development have already been purchased by or for the Company.

3119 There is no navigation in this section of the River, except ferry travel which will not be interfered with by the development, nor is there any navigation for approximately 160 miles below the proposed development. The proposed Project

will be constructed and operated so as not to impair the navigable capacity of the stream below, nor to affect the interests of interstate or foreign commerce.

The foregoing description of Project of New River Development Company is a part of the Declaration of Intention made by the undersigned this 25th day of June 1925.

NEW RIVER DEVELOPMENT COMPANY,
By GEO. N. TIDD, *Vice-President.*

Attest:
[SEAL] FRANK B. BALL, *Secretary.*

Exhibit C

STATEMENT WITH REFERENCE TO APPLICATION FOR PERMIT OR LICENSE

If the Commission should find that the Project will affect the interests of interstate or foreign commerce the Board of Directors of the Declarant Company, immediately upon receipt of advice to such effect, will consider and determine whether
3120 the Declarant proposes to apply for a permit or for a license.

This statement is a part of the Declaration of Intention made by the Undersigned this 25th day of June 1925.

NEW RIVER DEVELOPMENT COMPANY,
By GEO. N. TIDD, *Vice-President.*

Attest:
[SEAL] FRANK B. BALL, *Secretary.*

3121 *Government exhibit No. 89*

1926, Aug. 30—Assignment of Declaration of Intention of New River Development Co. to Appalachian Electric Power Co. (Original Exhibit.)

3122 *Government exhibit No. 90*

APPALACHIAN ELECTRIC POWER COMPANY

APPLICATION TO FEDERAL POWER COMMISSION FOR LICENSE (UNDER ACT OF JUNE 10, 1920) FOR DEVELOPMENT NO. 6, NEW RIVER A MAJOR PROJECT IN THE STATE OF VIRGINIA

1. Appalachian Electric Power Company, a corporation organized and existing under and by virtue of the laws of the State of Virginia, and having its office and principal place of business at

the City of Richmond, in the State of Virginia, does hereby make application to the Federal Power Commission for a license for a project described herein and shown on general and detailed maps signed by applicant on the 30th day of August, 1926, which maps are filed herewith and made a part hereof, said license to authorize the construction, operation and maintenance of certain project works, the principal ones of which are designated as follows on said maps:

(a) Dam and Reservoir.—Concrete dam, height 110 feet, across New River. Reservoir approximately 19 miles long cre-
3123 ated by dam. Surface area of Reservoir approximately 4,000 acres.

(b) Water Conduits.—Turbines will be connected to intakes by steel penstocks imbedded in retaining section of dam.

(c) Power House.—Power House will be a brick and steel structure containing 4 and possibly 5—15,000 K. W. alternating current generators.

(d) Transmission lines.—Power is generated at 13,200 volts 60 cycles, and is conducted into the transmission system already in operation located outside of project boundary about 500 feet from Power House.

2. The location of the project applied for is as follows:

(a) In the State of Virginia;

(b) In the County of Pulaski;

(c) On the following named stream: New River. Navigable and carrying commerce to the following extent: None, but tributary to the Kanawha River, which is navigable and carrying commerce up to Montgomery, W. Va., 155 miles below the project.

(d) In the region of the following named cities and towns: Radford, Virginia; Pulaski, Virginia.

3. The proposed scheme of development for project is as follows:

A concrete dam across New River 1627 feet long made up as follows:

| | Length | Max. height |
|---|---|---|
| | *Feet* | *Feet* |
| South retaining section | 240 | 100 |
| Intake section | 210 | 128 |
| Spillway section | 715 | 115 |
| Flood gate section | 282 | 72 |
| North retaining section | 180 | 42 |

South of the main dam a small dyke will be required about 300 feet long and 30 feet high.

The spillway allows for 6 feet overflow for a length of 675 feet and the gate section contains 4 flood gates 30′ x 50′.

3124 Power house is adjacent to and below south end of dam and will comprise 4 or possibly 5, 20,000 H. P. vertical shaft turbines driving 15,000 K. W. 60 cycle generators. Turbines will have steel scroll cases connected to intakes by steel penstocks imbedded in retaining section of dam. The operating head will range from 100 to 110 feet.

4. The proposed market for the power to be developed is as follows:

All power which can be generated will be fed to an interconnected transmission system now in operation, which passes the proposed project site, and is connected with an operating network which is already generating approximately 300,000 K. W. by steam and water power and rapidly increasing. Network is interconnected from Ohio down to North Carolina.

All power generated can be utilized as soon as available.

5. The location and capacity of all power projects owned or operated by the applicant, the markets supplied thereby and the relation thereof to the Project applied for, are briefly described as follows:

| | Location | Capacity |
|---|---|---|
| Glen Lyn Steam Plant | Glen Lyn, Virginia | 85,000 K. W. |
| Cabin Creek Steam Plant | Cabin Creek, West Va | 83,200 K. W. |
| Logan Steam Plant | Logan, West Va | 40,000 K. W. |
| Kenova Steam Plant | Kenova, West Va | 16,750 K. W. |
| Back Water Creek Steam Plant | Lynchburg, Virginia | 3,000 K. W. |
| Walnut Avenue Steam Plant | Roanoke, Virginia | 7,000 K. W. |
| Slack Street Steam Plant | Charleston, West Va | 8,450 K. W. |
| Hazard Steam Plant | Lothair, Kentucky | 16,000 K. W. |
| Sprigg Steam Plant | Sprigg, West Va | 7,500 K. W. |
| Byllesby Hydro Plant | Byllesby, Virginia | 18,000 K. W. |
| Buck Hydro Plant | Buck, Virginia | 6,210 K. W. |
| Reussens Hydro Plant | Lynchburg, Virginia | 4,500 K. W. |
| Niagara Hydro Plant | Roanoke, Virginia | 2,926 K. W. |
| Total | | 298,536 K. W. |

The foregoing include all the plants of the applicant and its subsidiary companies.

Applicant, together with its subsidiary companies, supplies electric energy to the western portion of Virginia, the southern half of West Virginia and the eastern portion of Kentucky.

The total K. W. H. output of applicant's system for the year 1925 was approximately 860,000,000 K. W. H. This output
3125 of electric energy was used in the various industrial communities in Virginia and West Virginia and Kentucky, a large proportion of the coal in this region being mined thereby and many chemical works being operated thereby, in addition to the service of light and power to many cities and communities.

The project applied for will, upon completion, become part of the above described system and will supply additional electric energy which is demanded by the territory served.

6. The following exhibits are filed herewith and are hereby made a part of this application:

Exhibit A: Certified copy of Organization papers;

Exhibit B: Other evidence that Applicant is qualified to proceed with the Project applied for;

Exhibit C: Statement re field notes of Project boundary;

Exhibit D: Statement re applicant's compliance with requirements of laws of State of Virginia;

Exhibit E: Statement of nature, extent and ownership of water rights;

Exhibit F: Statement of nature, extent and ownership of lands;

Exhibit G: Statement concerning financial ability of applicant to carry out project applied for;

Exhibit H: Statement of effect of Project on stream flow;

Exhibit I: Estimate of power capacity of project;

Exhibit J: General map covering the entire project area;

Exhibit K: Detail map covering entire project area;

Exhibit L: General design drawings of principal structures and appurtenant works;

Exhibit M: General descriptions and specifications of mechanical, electrical and transmission equipment;

Exhibit N: Estimate of cost of developing project;

Exhibit O: Statement of time desired for completing construction of project works.

In witness whereof the applicant has caused its name and corporate seal to be hereunto signed and affixed by N. M. 3126 Argabrite, its Vice-President thereunto duly authorized, this 30th day of August, 1926.

APPALACHIAN ELECTRIC POWER COMPANY,
By (S) N. M. ARGABRITE, *Vice-President.*

Attest:

(s) FRANK B. BALL, *Secretary.*

Exhibit A—Pursuant to Regulation 4, Section 1

APPLICATION FOR LICENSE—APPALACHIAN ELECTRIC POWER COMPANY

CERTIFIED COPY OF ORGANIZATION PAPERS

Organization papers of the applicant are submitted herewith, as Exhibit A, as follows:

1. Copy of Articles of Association of Appalachian Electric Power Company, filed in the office of the Secretary of the Commonwealth of Virginia, March 4, 1926, certified by the Secretary of the Commonwealth of Virginia.

2. Copy of Merger Agreement, Appalachian Electric Power Company, Appalachian Power & Light Company and Appalachian Power Company, filed in the office of the Secretary of the Commonwealth May 1, 1926, certified by the Secretary of the Commonwealth of Virginia.

This statement is a part of the application for license made by the undersigned this 30th day of August, 1926.

APPALACHIAN ELECTRIC POWER COMPANY,
By (S) N. M. ARGABRIT, *Vice-President.*

3164 Exhibit D—Pursuant to Regulation 4, Section 4

APPLICATION FOR LICENSE—APPALACHIAN ELECTRIC POWER COMPANY

STATEMENT RE APPLICANT'S COMPLIANCE WITH REQUIREMENTS OF LAWS OF STATE OF VIRGINIA

Applicant is a corporation duly organized and existing under the laws of the State of Virginia, with powers to construct, maintain and operate works, including all kinds of water, electric and other power plants, to be used for public service in the business of a general electric lighting and power corporation, with all the rights, powers, and privileges of such corporations under the laws of the State of Virginia. Such rights and powers include statutory right and power to acquire by condemnation, in the event the applicant cannot agree with the owners upon terms of purchase, all lands and rights, including rights as to bed and banks of the stream, necessary to construct, maintain and operate the project applied for.

There are no other requirements of the laws of the State of Virginia with respect to bed and banks and with respect to the right to engage in the developing, transmitting, and distributing of power and in any other business necessary to effect the purposes of the license applied for, which need be complied with by the applicant.

This statement is a part of the application for license made by the undersigned this 30th day of August 1926.

APPALACHIAN ELECTRIC POWER COMPANY,
By N. M. ARGABRITE, *Vice-President.*

Exhibit E—Pursuant to Regulation 4, Section 5

APPLICATION FOR LICENSE—APPALACHIAN ELECTRIC POWER COMPANY

3165 STATEMENT OF NATURE, EXTENT AND OWNERSHIP OF WATER RIGHTS

Under Virginia law water rights pertain to the riparian owners, on nonnavigable streams such as New River. Applicant and its predecessors in interest have been engaged for many years past in negotiation for the purchase of riparian lands and appurtenant water rights required for the project applied for and has acquired by purchase approximately eighty percent (80%) of the necessary riparian lands, with appurtenant water rights. It has proceeded, as far as practicable, in perfecting its rights to use sufficient water for proper operation of the project works and has found that it will be necessary to institute condemnation proceedings to acquire the balance of the necessary water rights.

There exists in Virginia no State agency authorized or empowered to give a certified statement setting forth the extent and validity of the applicant's water rights.

No approval or permission of any State agency is required by Virginia law as a condition precedent to the applicant's right to take or use water for the operation of the project works.

This statement is a part of the application for license made by the undersigned this 30th day of August 1926.

APPALACHIAN ELECTRIC POWER COMPANY,
By N. M. ARGABRITE, *Vice-President.*

Exhibit F—Pursuant to Regulation 4, Section 6

APPLICATION FOR LICENSE—APPALACHIAN ELECTRIC POWER COMPANY

STATEMENT OF THE NATURE, EXTENT AND OWNERSHIP OF LANDS

Approximately 80% of the total acreage of lands required for the construction and operation of the project, includ-
3166 ing all land within the project area, has already been acquired by the Applicant. The Applicant plans to acquire the balance of the necessary lands by condemnation proceedings under the laws of the State of Virginia and or under the Federal Water Power Act.

The applicant at the time of filing this application has acquired the right to occupy and use lands owned by others as follows:

| Acquired from | Date | Nature of right | Term | Expiration of term |
|---|---|---|---|---|
| S. T. Rigney, et ux | 4/12/24 | To submerge lands | Perpetual | |
| Bruce Clark, et ux | 3/11/25 | To submerge lands | Perpetual | |
| F. E. Roope | 9/19/23 | Railroad right-of-way | Perpetual | |
| H. L. Flagg, et ux | 9/19/23 | Railroad right-of-way | Perpetual | |
| W. C. Flinchum, et ux | 9/19/23 | Railroad right-of-way | Perpetual | |
| W. A. Earhart | 9/21/23 | Railroad right-of-way | Perpetual | |
| Bd. Supervisors, Pulaski County | 6/22/25 | To submerge lands | Perpetual | |

This statement is part of the application for license made by the undersigned this 30th day of August, 1926.

APPALACHIAN ELECTRIC POWER COMPANY,
By N. M. ARGABRITE, *Vice-President.*

## Exhibit G—Pursuant to Regulation 4, Section 7

### APPLICATION FOR LICENSE—APPALACHIAN ELECTRIC POWER COMPANY

#### STATEMENT CONCERNING FINANCIAL ABILITY OF APPLICANT TO CARRY OUT PROJECT APPLIED FOR

Applicant is a going concern, owning and operating, directly and through subsidiary corporations, extensive electric light and power properties in the States of Virginia, West Virginia, and Kentucky.

Applicant's capitalization is substantially as follows:

| | Outstanding with public |
|---|---|
| Funded Debt: | |
| Underlying Divisional Bonds | $23,991,000 |
| 3167 First and Refunding Mortgage Gold Bonds 5% Series of 1956 | 35,000,000 |
| Appalachian Power Company 6% Gold Debentures | 4,000,000 |
| 6% Note due on or before April 1, 1929 | 5,000,000 |
| Capital Stock (no par value): | |
| Preferred Stock, $7 Cumulative | 225,000 Shares |
| Second Preferred Stock, $7 Cumulative | 100,000 Shares |
| Common Stock | 5,000,000 Shares |

Earnings for the twelve months ending February 28, 1926 derived from properties now owned by the applicant and its subsidiary corporations were substantially as follows:

| | |
|---|---|
| Gross Earnings | $15,380,631 |
| Operating Expenses, Maintenance and Taxes | 7,474,502 |
| Net Earnings | $7,906,129 |
| Annual Interest Requirements on Underlying Divisional Bonds held by the Public | $1,249,550 |
| $35,000,000 First and Refunding Mortgage Gold Bonds | 1,750,000 |
| | 2,999,550 |
| Balance available for other charges, renewals and replacements reserves, dividends, etc | $4,906,579 |

It has recently marketed an issue of $35,000,000 First and Refunding Mortgage Gold Bonds (included in the capitalization above set forth) on a 5.20% yield basis. Its financial resources are deemed sufficient to finance the project applied for, which is designed to form one of the production units of applicant's system, the development of which is in response to the growth of an already existing consumers' demand for electric energy.

This statement is a part of the application for license made by the undersigned this 30th day of August 1926.

APPALACHIAN ELECTRIC POWER COMPANY,
By N. M. ARGABRITE, *Vice-President.*

3168 Exhibit H—Pursuant to Regulation 4, Section 8

APPLICATION FOR LICENSE—APPALACHIAN ELECTRIC POWER COMPANY

STATEMENT OF EFFECT OF PROJECT ON STREAM FLOW

Proposed reservoir will back up water for approximately 19 miles above dam. Surface area of reservoir about 4,000 acres. Storage with 10 foot draft on reservoir 40,000 acre feet.

The minimum flow proposed to be released during periods of low water shall be such amount as shall be required for the purposes of power, navigation, flood control and municipal water supply. The proposed ponding of water will tend to equalize seasonal variations, to increase the mimimum flow during low water periods and reduce flood peaks below the project.

This statement is a part of the application for a license made by the undersigned this 30th day of August 1926.

APPALACHIAN ELECTRIC POWER COMPANY,
By N. M. ARGABRITE, *Vice-President.*

Exhibit I—Pursuant to Regulation 4, Section 9

APPLICATION FOR LICENSE—APPALACHIAN ELECTRIC POWER COMPANY

ESTIMATE OF POWER CAPACITY OF PROJECT

Estimate of power capacity of the project is the continued product of:

A. The factor, 0.08.

B. The average static head in feet, viz, 106 feet; and

C. The water supply in cubic feet per second and not in excess of the hydraulic capacity of the approved project works, esti-

mated (from duration curve) to be available from net flow or from storage, or from both, for 90% of the time, viz, 1,200, equals 10,176 H. P.

3169 Data upon which such estimate is based is attached hereto and submitted herewith, viz: Duration curve, marked Exhibit I–A (for static head, see Exhibit L–4).

A list of all sources of power for the system of which the project will be a part is set forth in Exhibit A–5, hereto attached, to which reference is hereby made.

This statement is a part of the application for license made by the undersigned this 30th day of August 1926.

APPALACHIAN ELECTRIC POWER COMPANY,
By N. M. ARGABRITE, *Vice-President.*

Exhibit J—Pursuant to Regulation 4, Section 10

APPLICATION FOR LICENSE—APPALACHIAN ELECTRIC POWER COMPANY

GENERAL MAP COVERING ENTIRE PROJECT AREA

A general map covering the entire project area showing drainage area and important features of the project, state and county lines, etc., on a single sheet, is submitted herewith denominated "Exhibit J." This map is accompanied by two blue prints.

This statement is a part of the application for license made by the undersigned this 30th day of August 1926.

APPALACHIAN ELECTRIC POWER COMPANY,
By N. M. ARGABRITE, *Vice-President.*

Exhibit K—Pursuant to Regulation 4, Section 10

APPLICATION FOR LICENSE—APPALACHIAN ELECTRIC POWER COMPANY

DETAIL MAP COVERING ENTIRE PROJECT AREA

3170 Detail map covering entire project area, on a single sheet, is submitted herewith, denominated "Exhibit K." The drawing is accompanied by two blue prints. The lands marked on said map "A. P. Co." are owned by the applicant. The lands for which applicant holds rights of use and occupancy for purposes of the project are referred to in "Exhibit F" hereof.

This statement is a part of the application for license made by the undersigned this 30th day of August 1926.

APPALACHIAN ELECTRIC POWER COMPANY,
By N. M. ARGABRITE, *Vice-President.*

Exhibit L—Pursuant to Regulation 4, Section 12

APPLICATION FOR LICENSE—APPALACHIAN ELECTRIC POWER COMPANY

GENERAL DESIGN DRAWINGS OF PRINCIPAL STRUCTURES AND APPURTENANT WORKS

The following drawings are submitted herewith:
L-1 Elevation and Plan of Dam Site;
L-2 Flood Gates;
L-3 Profile of Diamond Drill Holes;
L-4 Cross Section and Analysis of Dam;
L-5 Analysis of Flood Gate Piers.
Each drawing is accompanied by two blueprints.
This statement is a part of the application for license made by the undersigned this 30th day of August 1926.

APPALACHIAN ELECTRIC POWER COMPANY,
By N. M. ARGABRITE, *Vice-President.*

Exhibit M—Pursuant to Regulation 4, Section 13

APPLICATION FOR LICENSE—APPALACHIAN ELECTRIC POWER COMPANY

3171 GENERAL DESCRIPTIONS AND SPECIFICATIONS OF MECHANICAL ELECTRICAL AND TRANSMISSION EQUIPMENT

Hydraulic Data—4 vertical shaft Francis type single runner turbines, steel scroll cases, details concerning which will later be submitted. (A 5th unit may be installed.) Nominal rating 20,000 H. P.

Generator & Exciter Data—4 vertical shaft 13,200 volt 60 cycle alternating current generators with direct connected exciters (a 5th unit may be installed), details concerning which will later be submitted.

Transmission—Cables will be led from generators through conduits to interconnected transmission systems beyond the project boundary where voltage will be transformed to system voltage.

This statement is a part of the application for a license made by the undersigned this 30th day of August 1926.

APPALACHIAN ELECTRIC POWER COMPANY,
By N. M. ARGABRITE, *Vice-President.*

## Exhibit N—Pursuant to Regulation 4, Section 14

### APPLICATION FOR LICENSE—APPALACHIAN ELECTRIC POWER COMPANY

### ESTIMATE OF COST OF DEVELOPING PROJECT

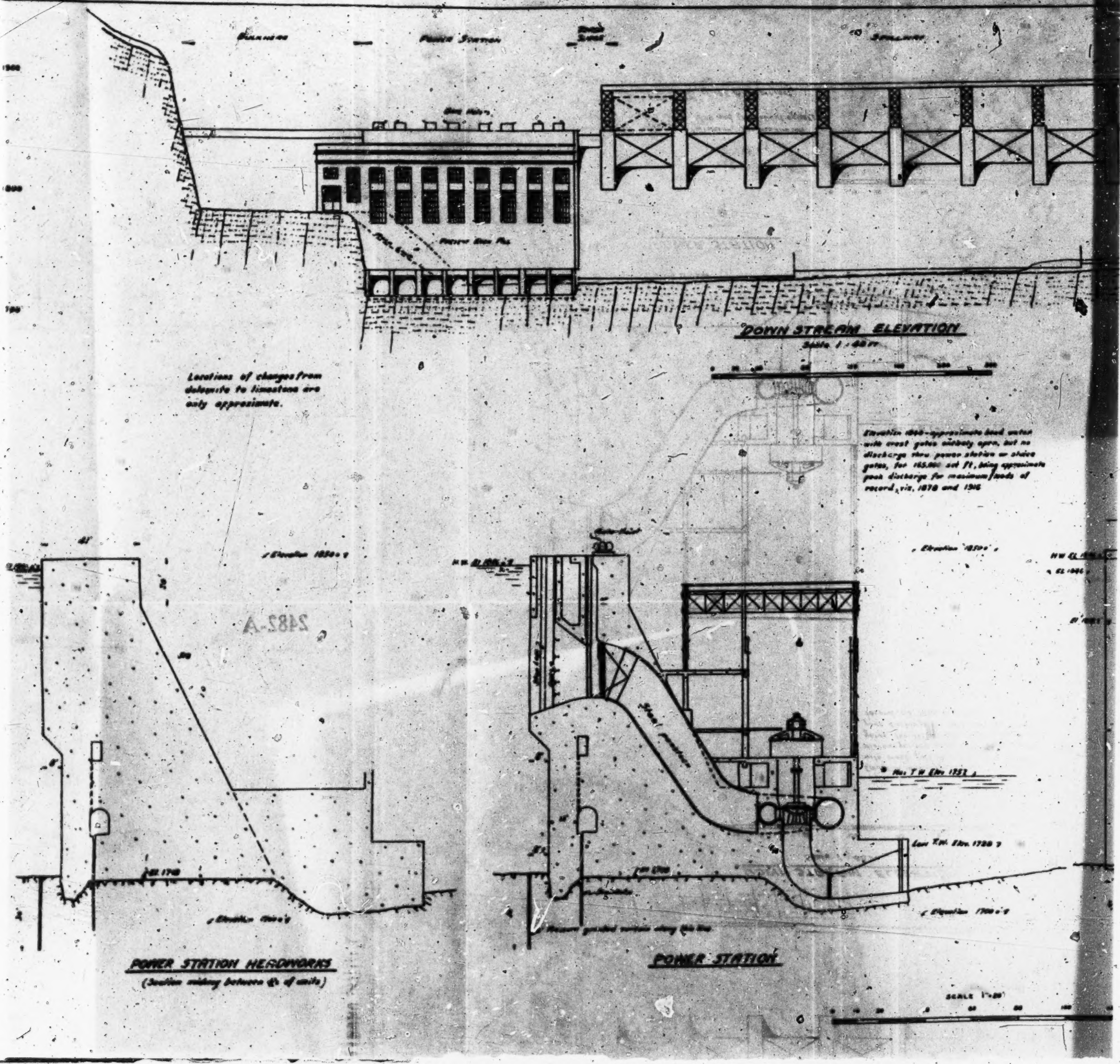
Estimate of cost of developing the project is as follows:

| | |
|---|---|
| Unwatering | $200,000 |
| Preparing bottom | 50,000 |
| No. retaining wall, 180': | |
| Excavation—Earth, 1,200 c. y. @ $1 | 1,200 |
| Excavation—Rock, 500 c. y. @ $4 | 2,000 |
| Concrete 3,000 c. y. @ $8.50 | 25,500 |
| Reinforcing 5,000# @ $0.05 | 250 |
| | 28,950 |
| Flood gates, 282': | |
| Excavation—Earth, 14,000 c. y. @ $1 | 14,000 |
| Excavation—Rock, 3,000 c. y. @ $4 | 12,000 |
| Concrete 20,000 c. y. @ $9 | 180,000 |
| Reinforcing 100,000# @ $0.05 | 5,000 |
| 3172 4 Stoney Gates, hoist & towers 30' x 50' | 130,000 |
| 1 set of stop logs & hoist | 17,000 |
| Lights, power, wiring, etc | 5,000 |
| | 363,000 |
| Spillway section, 715': | |
| Excavation—Earth, 13,000 c. y. @ $1 | 13,000 |
| Excavation—Rock, 8,000 c. y. @ $4 | 32,000 |
| Concrete, 160,000 c. y. @ $8 | 1,280,000 |
| Reinforcing, 200,000# @ $0.05 | 10,000 |
| Trash chute logs & details | 1,500 |
| Tunnel, stairs, etc | 5,000 |
| Flashboards 675' x 5' | 5,000 |
| | 1,346,500 |
| Intake section, 210': | |
| Excavation—Earth, 17,000 c. y. @ $1 | 17,000 |
| Excavation—Rock, 2,000 c. y. @ $4 | 8,000 |
| Concrete, 49,000 c. y. @ $8.50 | 416,500 |
| Reinforcing, 100,000# $0.05 | 5,000 |
| Racks, supports, guides, etc. 6,000 sq. ft. @ $4 | 24,000 |
| 1 gate and gantry | 20,000 |
| 4—16' ¢ penstocks 660,000# @ $0.08 | 52,800 |
| Pipings, cover, lights, power, etc | 5,000 |
| | 548,300 |
| South retaining wall, 240': | |
| Excavation—Earth, 8,000 c. y. @ $1 | 8,000 |
| Excavation—Rock, 2,000 c. y. @ $4 | 8,000 |
| Concrete, 24,000 c. y. @ $8.50 | 204,000 |
| Reinforcing, 40,000 lbs. @ $0.05 | 2,000 |
| | 222,000 |

| | |
|---|---|
| Dam in hollow south of main dam, 325': | |
| Excavation | $1,000 |
| Core wall concrete, 1,200 c. y. @ $12 | 14,400 |
| Earth fill, 16,000 c. y. @ $0.75 | 12,000 |
| | 27,400 |
| Power house substructure, 210: | |
| Excavation—earth, 13,000 c. y. @ $1 | 13,000 |
| Excavation—rock, 6,000 c. y. @ $2.50 | 15,000 |
| Concrete, 19,000 c. y. @ $14.00 | 266,000 |
| Reinforcing, 600,000# $0.05 | 30,000 |
| Piping | 5,000 |
| | 329,000 |
| Power house superstructure: | |
| 730,000 cu. ft | 165,000 |
| Tail race: | |
| Excavation—Earth, 72,000 c. y. @ $0.75 | 54,000 |
| Excavation—Rock, 22,000 c. y. @ $2.50 | 55,000 |
| Concrete, 9,000 c. y. @ $9.00 | 81,000 |
| | 190,000 |
| Power house equipment: | |
| Water Wheels, gov. etc., 80,000 H. P., @ $3.50 | 280,000 |
| Frt. & erection | 42,000 |
| Generators & exciters, 60,000 K. W., @ $8 | 480,000 |
| Frt. & erection | 48,000 |
| Switchboard & switches | 50,000 |
| Frt. & erection | 10,000 |
| Pumps, piping & elec. supplies | 25,000 |
| 75 ton crane | 19,000 |
| 4, 16' ¢ Butterfly valves | 120,000 |
| Frt. & erection | 12,000 |
| | 1,086,000 |
| 3173 Camp & plant: | |
| Clearing & grubbing camp site | 5,000 |
| 10 cottages @ $4,250 (permanent operators) | 42,500 |
| Temporary buildings & equipment | 80,000 |
| Construction plant | 350,000 |
| Maintenance of Const. plant | 70,000 |
| Construction trestles | 25,000 |
| R. R. siding | 20,000 |
| Roads | 25,000 |
| | 617,500 |
| | $5,173,650 |

*Government exhibit No. 90-A*

In addition to the sheet of plans printed below, Exhibit 90-A contains 5 sheets of plans, each of which carries the notation "War Department, approved so far as the plans affect the navigable capacity of navigable waters of the United States" which approval is signed by the Chief of Engineers and the Secretary of War.



hibit 90-A
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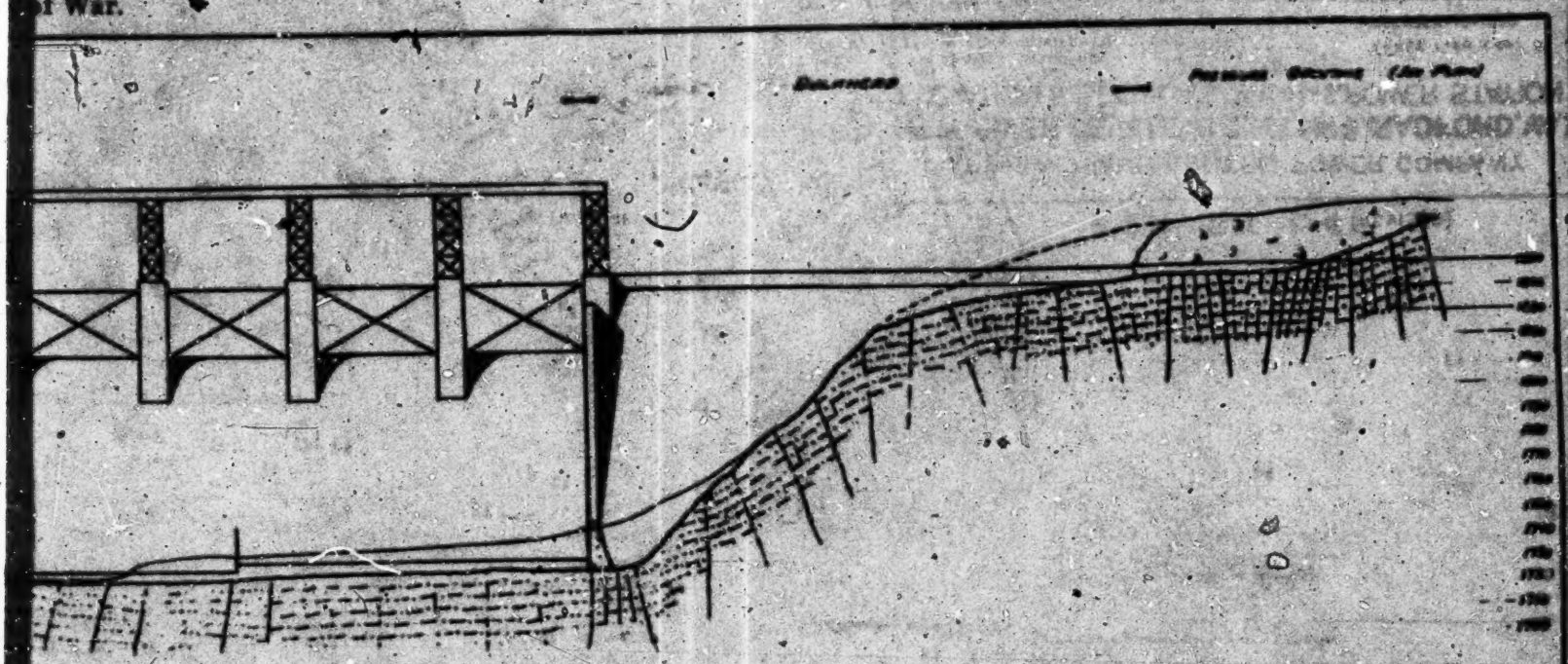
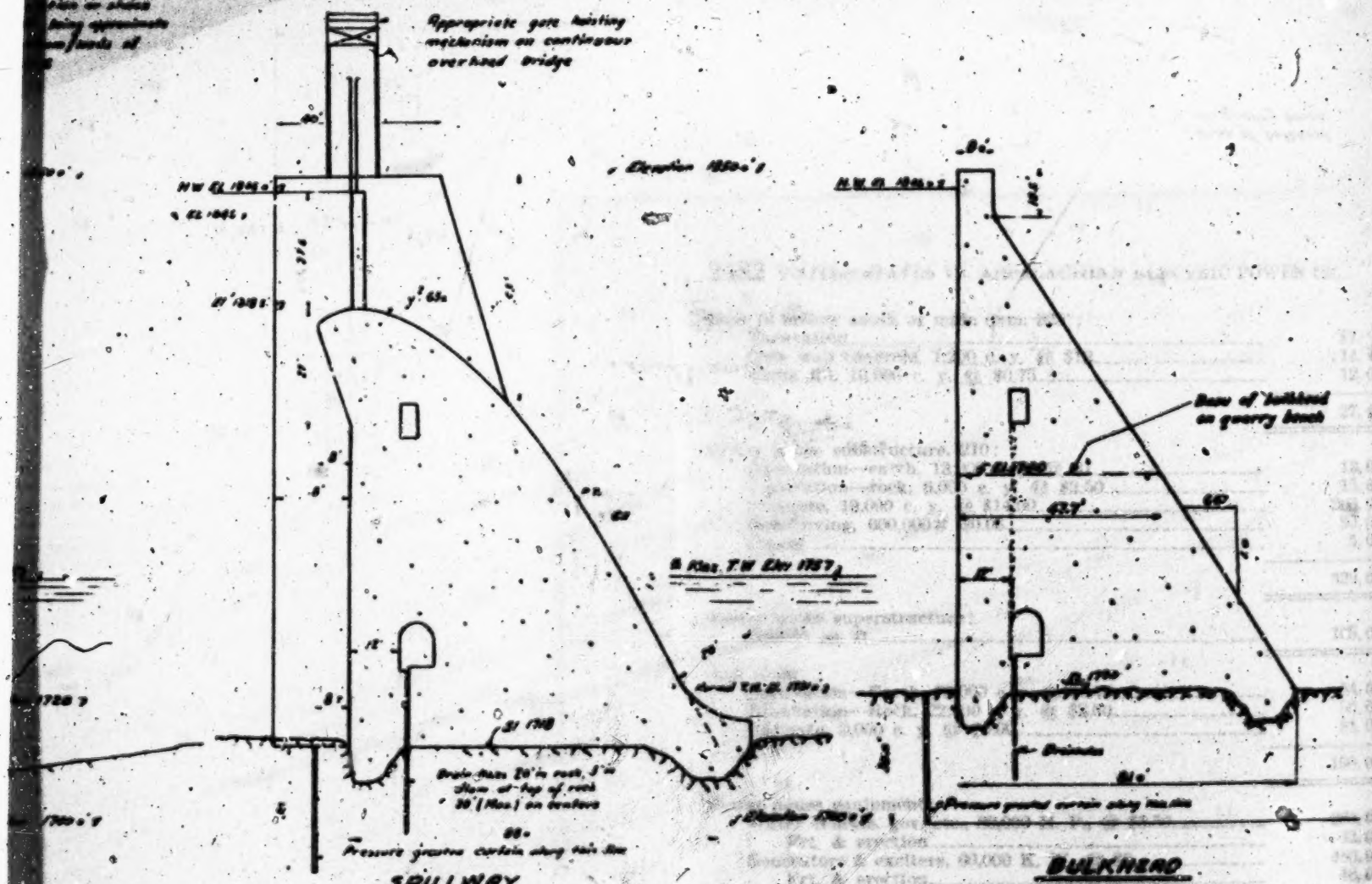
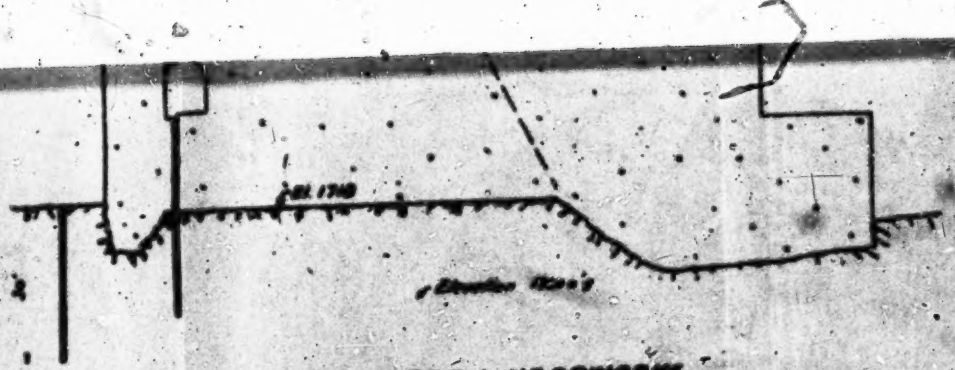
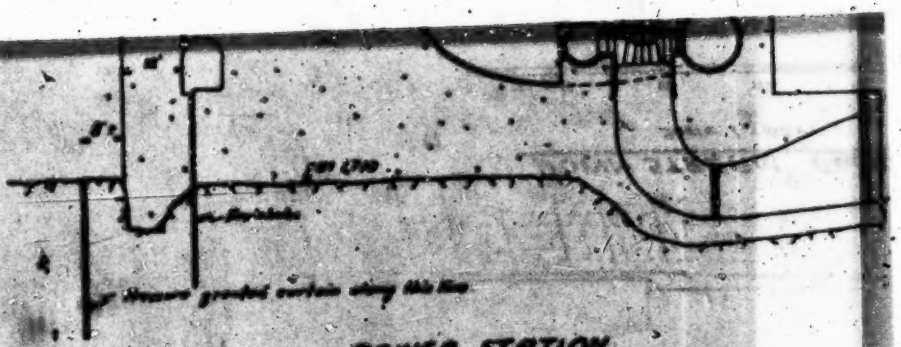







POWER STATION HEADWORKS

(Section midway between ℄s of units)

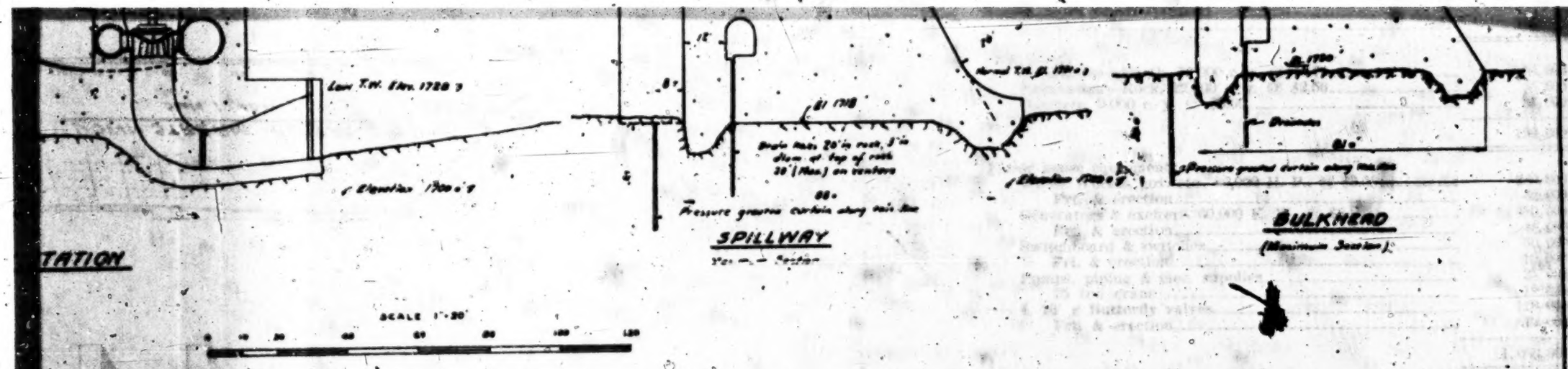



POWER STATION

* Approximate maximum tailwater, for maximum floods of record, viz., 1870 and 1881 (about equal).

Notes

Elevations are in terms of N.E.P.Co. project datum which is approximately seven sea level.




WAR DEPARTMENT

This drawing Exhibit L-4 is a part of the application for license made by the undersigned the 30th day of August, 1926

APPALACHIAN ELECTRIC POWER COMPANY

By _____

Vice President

October 4, 1926

EXHIBIT L-4 (REVISED)

APPALACHIAN ELECTRIC POWER COMPANY

NEW RIVER DEVELOPMENT No 8 (RADFORD, VA)

ELEVATION & SECTIONS OF DAM & POWER STATION

DANIEL W. MEAD
F. W. SCHEIDENHELM
CONSULTING ENGINEERS

SCALE 1"=20' & 40'
OCTOBER-10-1926

734-12

AEP-RD-3005

U. S. GOVERNMENT PRINTING OFFICE : 1943—D-213035

| | |
|---|---|
| General expense: | |
| Clearing, reservoir, 3,000 A @ $10 | $30,000 |
| New Highway, 10 mi. @ $5,000 | 50,000 |
| Motorizing 4 Ferries | 10,000 |
| 2 New ferries, Peek Creek | 10,000 |
| Concrete casing to R. R. Viaduct | 2,000 |
| Raising Highway Bridge | 6,000 |
| Insurance on labor | 50,000 |
| Fire Insurance & protection | 10,000 |
| | 168,000 |
| | $5,341,650.00 |
| Superintendence, engineering, and contingencies 15% | 801,247.50 |
| | $6,142,897.50 |

The above estimate does not include the following items: Cost of property, interest during construction.

This statement is a part of the application for a license made by the undersigned this 30th day of August 1926.

APPALACHIAN ELECTRIC POWER COMPANY,
By N. M. ARGABRITE, *Vice-President.*

3174 Exhibit O—Pursuant to Regulation 4, Section 15

APPLICATION FOR LICENSE—APPALACHIAN ELECTRIC POWER COMPANY

STATEMENT OF TIME DESIRED FOR COMPLETING CONSTRUCTION WORKS

A period of one year from the date of license is desired for beginning construction of the project works and a period of four years from the date of license is desired for completing construction of the project works.

This statement is a part of the application for a license made by the undersigned this 30th day of August, 1926.

APPALACHIAN ELECTRIC POWER COMPANY,
By N. M. ARGABRITE, *Vice-President.*

3176 *Government exhibit 91*

SIXTH ANNUAL REPORT OF THE FEDERAL POWER COMMISSION

FISCAL YEAR ENDED JUNE 30, 1926

3177. Seventy-seventh meeting, held in the office of the Secretary of War, March 2, 1926

Meeting called to order at 3.45 p. m.

Present: Secretary Davis, chairman, Secretary Work and Secretary Jardine, members of the commission; O. C. Merrill, execu-

tive secretary; Maj. Glen E. Edgerton, chief engineer; Maj. Paul S. Reinecke and D. J. Guy, assistant engineers; Maj. Lewis W. Call, chief counsel; and William V. King, chief accountant.

The meeting was devoted in part to a public hearing on the declaration of intention of the New River Development Co. to construct a power project on New River about 7 miles above East Radford, Va. Attorneys for the declarant were heard by the commission in appeal from the tentative conclusion of the executive secretary that the project would affect the interests of interstate or foreign commerce. The Attorney General and the counsel for the corporation commission of the State of Virginia also appeared in opposition to the assumption of jurisdiction over the project by the Federal Power Commission.

A report of the hearing made by Douglas O. Morgan, shorthand reporter, is in the files of the commission.

At the conclusion of the hearing, the commission took up the regular order of business in executive session.

Seventy-eighth meeting, held in the office of the Secretary of War, March 26, 1926

Meeting called to order at 4.15 p. m.

Present: Secretary Davis, chairman; Secretary Work and Secretary Jardine, members of the commission; O. C. Merrill, executive secretary; Maj. P. S. Reinecke, assistant chief engineer; Maj. Lewis W. Call, chief counsel; J. F. Lawson, assistant attorney; and William V. King, chief accountant.

The commission then took up the regular order of business in executive session.

The record of the proceedings of February 27, 1926, and March 2, 1926, was approved.

The executive secretary presented a list of three applications, Nos. 697, 698, and 699, received since the meeting of March 2, 1926, and stated that three projects had been advertised.

Authorization for license—Declaration of intention

The executive secretary submitted the following statement: The New River Development Co., of New York City, organized under the laws of Virginia, on June 26, 1925, submitted a declaration of intention to the Federal Power Commission under the provisions of section 23 of the Federal water power act, covering the proposed construction of a dam and water power project across New River, in Pulaski County, near Radford, Va.

The New River rises in North Carolina, flows through Virginia and West Virginia, and 155 miles below the proposed dam in conjunction with the Gauley River forms the Kanawha River,

a navigable waterway of the United States. The proposed power project includes a concrete dam about 115 feet high with provision for raising its crest 5 feet by means of flashboards. The reservoir formed by the dam will be about 20 miles long,
3178 will have an area of 3,500 to 4,000 acres, and will have a storage capacity of more than 100,000 acre-feet of water.

The declaration of intention was referred to the Chief of Engineers for investigation and report. A report unfavorable to the contentions of the declarant was made, and at its request the papers were returned to the Chief of Engineers for the consideration of additional data furnished by the declarant. After reconsideration of the question, the Chief of Engineers reported that "so far as can be predicted from available data and records it would not be possible to operate the proposed project so as to adversely affect navigation on the Kanawha River under the existing project."

After study of the case by the commission's staff and the consideration of additional data not before the Chief of Engineers the declarant was informed that it was proposed to recommend to the commission that it find that the proposed project would affect the interests of interstate and foreign commerce. The attorneys for the declarant thereupon requested a hearing before the commission, which hearing was held on March 2. No new data were presented at the hearing, but arguments were made and briefs filed covering not only legal considerations but also the facts upon which the staff of the commission had reached its tentative conclusions.

The matter now comes before the commission for action, and the following review is submitted:

The greater part of the report of the Chief of Engineers is taken up with a discussion of whether New River is or is not a navigable stream. He concludes that it is not. In view of the fact that the navigability of the stream is at least doubtful is denied by the declarant, and in consequence a declaration of intention has been filed, the commission need not pass upon the question of navigability, over the determination of which it has been given no specific authority under the law, but may proceed to act upon the declaration as such under the duty imposed upon it by section 23 of the Federal water power act.

The second paragraph of section 23 of the act, respecting declarations of intention is as follows:

That any person, association, corporation, State, or municipality intending to construct a dam or other project works across, along, over, or in any stream or part thereof, other than those defined herein as navigable waters, and over which Congress has

jurisdiction under its authority to regulate commerce between foreign nations and among the several States, may in their discretion file declaration of such intention with the commission, whereupon the commission shall cause immediate investigation of such proposed construction to be made, and if upon investigation it shall find that the interests of interstate or foreign commerce would be affected by such proposed construction, such person, association, corporation, State, or municipality shall not proceed with such construction until it shall have applied for and shall have received a license under the provisions of this act. If the commission shall not so find, and if no public lands or reservations are affected, permission is hereby granted to construct such dam or other project works in such stream upon compliance with State laws.

Before the enactment of the Federal water power act authority to construct dams on navigable streams could be secured only by an act of Congress. There was no means of determining prior to actual erection and operation whether a dam on other streams would or would not affect the interests of commerce. Protection could be had, therefore, only by applying for legislative authority. It was to cure this situation that the provisions of section 23 as above quoted were included in the act. These provisions had two purposes: (1) To protect the interests of navigation by controlling the erection and operation of structures which might otherwise be injurious, rather than by abating the structures or compelling modification in their operation after they are
3179 erected; and (2) to protect applicants by providing a means whereby they can have an authoritative ruling before investment is made.

In the case of United States v. Rio Grande Dam & Irrigation Co. (178 U. S. 770), the Supreme Court said:

The jurisdiction of the general Government over interstate commerce and its natural highways vests in that Government the right to take all needed measures to preserve the navigability of the navigable water courses of the country.

In discussing the act of September 19, 1890 (26 Stat. 454), subsequently amended in March, 1899, which prohibits "the creation of any obstruction, not affirmatively authorized by law, to the navigable capacity of any waters in respect to which the United States has jurisdiction," the court said:

It is not a prohibition of any obstruction to navigation, but any obstruction to the navigable capacity, and anything, wherever done or however done, within the limits of the jurisdiction of the United States, which tends to destroy the navigable capacity of one of the navigable waters of the United States is within the terms of the prohibition.

When Congress, through the medium of the Federal water power act, fixed the conditions under which dams might be erected under its jurisdiction and empowered the Federal Power Commission to authorize such erection, it by so doing placed upon the commission the responsibility of taking "all needful measures to preserve the navigability of the navigable water courses of the country" in such cases. Where the stream was not navigable, or the effect upon navigation was in doubt, Congress gave prospective developers the option of having the relation of the project to navigation determined before construction by filing a declaration of intention with the commission, or of having such relation determined after construction through proceedings which might be instituted by the United States. But Congress did not give the Commission the option of directly or indirectly authorizing the erection of a dam with intent of having its effect upon navigation determined by other agencies after construction instead of by the commission before construction. The language of the act itself and the discussions upon it in Congress evidence the intent of Congress to place upon the commission and upon nobody else the duty of determining, when declarations of intention are filed, the effect of the proposed construction upon navigation, and to authorize the commission to waive the requirements of a license only when it is convinced that the project will not, in fact, either in its construction or in its operation affect the interests of interstate or foreign commerce.

There is no merit in the contentions made by the representatives of the declarant in their briefs and arguments that the commission is bound by the report and conclusions of the Chief of Engineers, on the ground either that the War Department is the authority to which the development and protection of navigable waters have been confined by Congress, or that the War Department is the sole investigating arm of the Federal Power Commission in matters affecting navigation. As stated above, whatever may be the provisions of other or earlier legislation, Congress in the Federal water power act placed upon the commission the responsibility of determining the effect of power dams on interstate and foreign commerce, a responsibility which it can not legally pass on to some other agency. If this were not so, there would have been no occasion for the declarant's appearance before the commission.

The act provides that "the work of the commission shall be performed by and through the Departments of War, Interior, and Agriculture, and their engineering, technical, clerical, and other personnel, except as may be otherwise provided by law." It does not provide that any particular work shall be performed by any specified agency. The commission may, if it wishes,

make its investigations of the effect of dams on navigation through individuals in the Agricultural or Interior
3180. Departments. Furthermore, the act provides for the detail by the President to the commission of an officer from the Engineer Corps to serve the commission as engineer officer. If the opinion on an engineer question of any individual were to be binding upon the commission, it would appear to be that of the officer detailed as its engineering adviser.

Since the close of the hearing representatives of the declarant have advanced the contention that since they failed to present at the hearing any evidence in support of their position other than the revised report of the Chief of Engineers, the commission in reaching its decision can give no consideration to any information or opinion from any other source. Even if the record before the commission did not contain data and conclusions other than this report of the Chief of Engineers, it would be competent for the commission, if it were not satisfied with the information before it, to secure any other or further information it might wish, whether or not presented at the hearing, and whether or not in the record of the case. The declarant was given a hearing. It was for the declarant to make its own case and to present whatever evidence it might wish. The hearing was ex parte. The declarant can not, by failure to produce evidence in rebuttal of what it knew the record contained, cause that evidence to be excluded from consideration by the commission. Furthermore, evidence other than the revised report of the Chief of Engineers is considered and argued in the briefs filed by the declarant as part of the record of the hearing.

Proceeding to a consideration of the reports and facts in the case which bear upon the question of the effect of the proposed power development upon navigation: In his first report of August 20, 1925, the Chief of Engineers said:

This river is one of the principal tributaries of the Kanawha River, which has been improved for about 90 miles by the construction of 10 locks. It is really the Kanawha River under another name, and the flow if not properly regulated could have an adverse effect on navigation during low water stages in the Kanawha River. * * *

To fully protect the interests of interstate or foreign commerce any license granted should be made subject to the following conditions:

1. That the licensee shall permit a continuous flow past its dam not less than the low-water flow of the stream as determined by the records of the stream gauging stations required by the preliminary permit, subject to such modifications as the Secretary of War may prescribe in the interests of navigation, and shall

not at any time interfere with the natural flow of the river to such an extent as to interfere with or impede navigation.

2. That the operations of the licensee, in so far as they affect the use, storage, and discharge of the river shall be controlled by such reasonable rules and regulations as the Secretary of War may prescribe in the interests of navigation.

Subsequently, the chief of engineers reported:

So far as can be predicted from available data and records it would not be possible to operate the proposed project so as to adversely affect navigation on the Kanawha River under the existing project.

The opinion of the Chief of Engineers with respect to lack of effect of the New River project upon navigation appears to be based upon two considerations: (1) That the drainage area below the proposed dam would alone supply "the necessary water for navigation on the Kanawha River under the existing project," and (2) that the character of the stream bed is such "that any periodic fluctuations in flow due to normal operations of the project works would be so attenuated by the time they had reached the Kanawha River 155 miles distant as to preclude the probability of any adverse effect upon navigation on that river."

With respect to the first consideration named: From records received and published by the United States Geological Survey, it appears that the monthly mean flow past the proposed dam,
3181 which controls 27.5 per cent of the total drainage area above lock 2 on the Kanawha, has been in times of low water 40 per cent or more of the total available at lock 2, with the percentage greater as the aggregate flow is less. Leakage alone through the locks and dam at lock 2 is estimated at 700 cubic feet per second, an amount greater than would be available in certain months were the water from the area above the proposed dam shut off. It is the opinion of the district engineer in charge of the Kanawha that approximately 1,100 cubic feet per second is needed for satisfactory operation of the Kanawha locks and dams. This amount might not be available for periods of two or more months, should the declarant fill its reservoir for the first or subsequent times under such run-off conditions as prevailed in September and October of 1902. This, however, is not the primary consideration in the possible effect of the use of storage capacity upon navigation. The most serious effects are likely to be caused by variations in river discharge during critical river stages.

In his revised report of December 29, 1925, the Chief of Engineers says, "There is no known method of computing with any degree of accuracy the effect of fluctuations in flow at the dam on

the stage of the river at various distances below the dam." He concludes, however, that under the conditions which it is assumed will obtain on the New River there is no probability of adverse effect on the Kanawha arising from variations in discharge from the power plant.

No actual data have been presented by representatives of the declarant to support their position. They have stated that the operation of existing plants on the New River does not show that variations in power plant discharge cause material variation in flow in the river; but they have submitted no data to support the statement. Their reliance is placed wholly upon the theoretical computations, which the Chief of Engineers correctly says have no value, upon the personal opinion of their own engineers supported by no data, and upon the statement of the Chief of Engineers that "so far as can be predicted from available data and records" there would be no adverse effect on navigation. The only evidence of real value would be actual measurements of variation upon the New River itself or upon some other comparable stream.

Subsequent to the receipt of the Chief of Engineer's revised report the staff of the commission secured detailed records showing the effect of variations in power plant discharge upon the flow of the Pit and Sacramento Rivers in California. The records cover a distance of 125 miles from the Pit No. 3 plants of the Pacific Gas & Electric Co. to Red Bluff on the Sacramento River 71 miles below the mouth of the Pit.

The data plotted on a uniform scale for four gauging stations show conclusively that quantitative variations in river discharge persist over long distances. The data were submitted to representatives of the declarant for their information and they have attempted to reply to them in their brief with the claim that the only portion of the stream covered by the diagram which is comparable with the New River is the 80-mile section from the Ydalpom gauge on the Pit to the Red Bluff gauge on the Sacramento. Of these 80 miles, 71 are on the main Sacramento River having a flatter slope than the New River. An examination of the diagram will show that for the 41 miles on the Pit between plant No. 3 and Ydalpom the quantitative variations in discharge are practically unchanged, and that in the 80 miles on the lower Pit and Sacramento 70 per cent of the variations still persist at Red Bluff.

If daily fluctuations of considerable magnitude are created in the Kanawha they will require at low stages of the river frequent operation of the movable dams, a use for which the dams are not intended, thereby increasing the difficulty and expense of

maintaining conditions suitable for navigation, if not making it impracticable.

A plant producing 60,000 kilowatts (the proposed installation, at a head of 100 feet) with an efficiency of 85 per cent will require a maximum flow of about 8,300 cubic feet per second.
3182 If operated on a "normal" load factor, the minimum flow used would be about one-third of the maximum, or 2,800 cubic feet per second, a daily variation of 5,500 cubic feet per second. If, on the other hand, as is becoming more frequently the practice, and as the proposed installation in the New River plant indicates, the plant should be operated as a "peak load" plant in connection with steam installation, it might be closed down entirely during certain periods of the day, causing an extreme variation in daily discharge of the full 8,300 cubic feet per second. If these variations are quantitatively reduced in the degree indicated on the Sacramento River—that is, with about one-third of the variation at the head of each 80-mile section disappearing in that section—the amount of the variation which would persist at the first lock on the Kanawha might vary from 2,000 to 4,000 cubic feet per second, according as the plant was operated on "normal" load factor or on "peak." Even if only one-third of the variation remains, the daily variations at lock 2 might still be from 1,500 cubic feet per second to 2,800 cubic feet per second.

The movable dams on the Kanawha River are usually kept up until the flow reaches approximately 6,000 cubic feet per second and then lowered. Should daily variations of from 1,000 cubic feet per second to 2,000 cubic feet per second be caused when the normal flow is in the vicinity of 6,000 cubic feet per second, constant raising and lowering of the dams would be involved, and serious interference with navigation would be caused. Furthermore, navigators are accustomed to note the stage of the stream as they pass a river gauge and to rely on there being no unusual change in the river stage until another gauge is reached. If variations in the flow, such as appear possible from unregulated operation of the storage on the New River should be of sudden and frequent occurrence, considerable damage to tows and to floating plant might readily result.

Experience on the Kanawha River has shown that no depletion of water supply in a dry season can be made without materially increasing the difficulty of maintaining conditions suitable for navigation. The proposed works have ample capacity not only to decrease the flow in the Kanawha River in considerable amount over long periods in the low-water season, but to cause such variation in daily river discharge as seriously to interfere

with operation of the navigation facilities. Under such circumstances it is believed to be the duty of the commission "to take all needed measures to preserve the navigability" of the Kanawha River; and that these measures can be taken only by requiring the dam to be constructed under a license containing such condition as will avoid the possibility of serious interference with navigation.

The commission, after discussion, directed that the case with the additional data collected be returned to the Chief of Engineers for further consideration.

3183 FISCAL YEAR ENDED JUNE 30, 1927

3184 Eighty-eighth meeting, held in the Office of the Secretary of War, June 1, 1927.

Meeting called to order at 9.25 a. m.

Present: Secretary Davis, chairman; Secretary Work, member of the commission; O. C. Merrill, executive secretary; Maj. Glen E. Edgerton, chief engineer; Maj. Lewis W. Call, chief counsel; J. F. Lawson, assistant counsel; and William V. King, chief accountant.

Decisions on declarations of intention

The executive secretary presented two declarations of intention submitted under section 23 of the Federal water power act upon which action was taken as follows:

1. The executive secretary made the following statement: The New River Development Co., of New York City, organized under the laws of Virginia, submitted on June 26, 1925, a declaration of intention covering the proposed construction of a power development on the New River in Pulaski County, near Radford, Va. Under date of September 2, 1926, Appalachian Electric Power Co., as successor in interest to New River Development Co., submitted an application for license for the project with the request that action upon the declaration of intention be deferred for consideration at the same time as the application for license. Since the investigation of the application for license is now complete and final action now awaits only the applicant's determination of the exact location for the dam, it is recommended that the commission proceed to make finding with respect to the declaration of intention.

The declaration of intention was referred to the Chief of Engineers in the usual manner who reported on August 20, 1925 that the project, if not properly regulated, could have an adverse

effect on navigation during the low-water stages in the Kanawha. Subsequently, after reviewing the case at the request of the applicant, the Chief of Engineers reported that "so far as can be predicted from available data and records it would not be possible to operate the proposed project so as to adversely affect navigation on the Kanawha River under the existing project." In reviewing the report of the Chief of Engineers the engineers of the commission had the advantage of certain studies made upon the Pit River in California showing the effect on the discharge of that river of irregular release of water from Pit No. 3 power plant of Pacific Gas and Electric Co. It was the conclusion of the engineers of the commission that these data clearly indicated the probability that adverse effects upon navigation on the Kanawha would be produced by intermittent discharges of water from the proposed power plant of New River Development Co. It was accordingly recommended to the commission that it find that the proposed project would affect the interests of interstate and foreign commerce, and in support of this recommendation a memorandum was submitted which appears at page 133 of the sixth annual report of the commission.

On account of the different conclusions of the executive secretary and the Chief of Engineers, the commission at its meeting of March 26 directed that the case, with the additional data collected, be returned to the Chief of Engineers for further consideration. On July 23, 1926, General Deakyne, Acting Chief of Engineers, reported as follows:

* * * * * *

"The previous report of this office, dated December 29, 1925, on the effect the proposed project would have on the navigation in the Kanawha River was based on records of stream flow from 1909 to 1916, inclusive. These records showed that during 3185 the period in question the drainage area below the proposed plant would provide sufficient water to meet the needs of navigation in the Kanawha River. The summer of 1925 was exceptionally dry, and considerable difficulty was experienced in maintaining navigation in the Kanawha River. It appears, therefore, that at long intervals there may be seasons in which the stream flow is smaller than that covered by the years 1909–1916 and during which the run-off from the area below Radford might be inadequate for navigational purposes.

"I therefore report that there is reason to believe that in the future exceptionally dry seasons may occasionally occur during which the proposed project near Radford, if unregulated, might adversely affect the navigable capacity of the Kanawha River."

In view of the importance to navigation interests of determining to what extent variations in river discharge produced by irregular power-plant operation may persist on the stream below the power plant, as was clearly indicated from the records of Pit River, the commission undertook to have studies made on other streams. A report under date of May 2, 1927, from the commission's representative in California of studies made on the Klamath River in that State bears out in full the conclusions reached from the Pit River records. Quantitative variations in river discharge on the Klamath River were reproduced in full 64 miles below the power plant and to approximately 75 percent at a distance of 132 miles.

For the reasons presented by the Chief of Engineers in the above-quoted report, and for the further reason of effect of irregular power-plant discharge as set forth in the memorandum presented to the meeting of March 26 and as confirmed by the report above referred to, it is concluded that the proposed project of New River Development Co. would affect the interests of interstate or foreign commerce, and it is recommended that the commission so find.

The commission thereupon took action as follows:

In the matter of the declaration of intention, under the provisions of section 23 of the Federal water power act, of New River Development Co., a corporation organized under the laws of the State of Virginia, to construct a dam and other structures across and in New River in the vicinity of Radford, Pulaski County, State of Virginia, said dam and other structures being part of a power project proposed to be constructed for the purpose, inter alia, of the development and utilization of power, said declaration having been submitted to the commission under date of June 26, 1925: The commission having caused investigation of such proposed construction to be made and it appearing from such investigation and from reports submitted thereon that said project, unless operated in the interests of interstate or foreign commerce in accordance with the requirements of said act, would have an adverse effect on such interests, but if operated in accordance with such requirements would materially benefit such commerce, thereupon found that said river in the part thereof involved in said declaration is not "navigable waters" within the definition thereof in said act, but that the interests of interstate or foreign commerce would be affected by such proposed construction.

2. The executive secretary stated that S. A. Lawrence, of Cleveland, Ohio, has declared his intention to construct a dam approximately 25 feet high across the North Fork of New River about 248 miles above Kanawha Falls and near Weaversford, in the

County of Ashe, State of North Carolina; that the Chief of Engineers has reported that the proposed project is on a tributary to the Kanawha River, a navigable waterway of the United States, but due to the small capacity of the proposed reservoir and the distance above the head of navigation he believes the project will have no adverse effect on the navigable capacity of the Kanawha River. The executive secretary recommended that the commission find that the interests of interstate or foreign commerce would not be affected by construction of the proposed project.

3186 The commission thereupon took action as follows:

In the matter of the declaration of intention of S. A. Lawrence, of Cleveland, Ohio, to construct a dam across and in North Fork of New River in the vicinity of Weaversford, in Ashe County, N. C., for the purpose of developing power: The commission having caused investigation of such proposed construction to be made and it appearing upon such investigation that said North Fork of New River in said vicinity is not "navigable waters" as defined in the Federal water power act, and that such proposed construction would not affect the interests of interstate or foreign commerce, it was voted that the commission finds that the interests of interstate or foreign commerce would not be affected by such proposed construction.

3187 FISCAL YEAR ENDED JUNE 30, 1928

3188 Ninety-third meeting, held in the office of the Secretary of War, May 28, 1928

Meeting called to order at 11 a. m.

Present: Secretary Davis, chairman; Secretary Work and Secretary Jardine, members of the commission; O. C. Merrill, executive secretary; Maj. Glen E. Edgerton, chief engineer; Maj. Paul S. Reinecke, assistant chief engineer; Maj. Lewis W. Call, chief counsel; J. F. Lawson, assistant counsel; and William V. King, chief accountant.

The record of the proceedings of March 26, 1928, was approved.

The executive secretary presented a list of 19 applications, Nos. 5, 497, 663, 862, and 887 to 901, inclusive, received since the meeting of March 26, 1928; and stated that nine applications had been advertised and two declarations of intention had been received.

Licenses confirmed—Miscellaneous

Secretary Jardine called attention to a request that had been received from Appalachian Electric Power Co. for a reference to the Attorney General of certain questions of law respecting the applicability of the Federal water power act and of the standard form of license issued thereunder to projects on nonnavigable streams. The request in the form of a letter of April 26, 1928, addressed to the commission and inclosing copy of a previous letter of March 1, 1928, is as follows:

APRIL 26, 1928.

(Identical with draft of April 12, 1928)

Hon. DWIGHT F. DAVIS, *Secretary of War;* Hon. HUBERT WORK, *Secretary of the Interior;* Hon. WILLIAM M. JARDINE, *Secretary of Agriculture*, constituting Federal Power Commission.

Subject: Project 739, Virginia Appalachian Electric Power Co.

SIRS: Appalachian Electric Power Co. proposes to construct a waterpower development near Radford, Va., on New River, a stream held by the War Department and the Federal Power Commission to be nonnavigable. The project would be located entirely within the State of Virginia and the nearest navigable waters, those of the Kanawha River to which the New River is a tributary, are in the State of West Virginia and more than 150 miles down-stream from the proposed power site. No land nor other property of the United States is involved.

Under date of March 1, 1928, this company addressed to the Federal Power Commission a request, a copy of which is inclosed herewith, that it issue for this project a license containing provisions limited to those which are relevant for the protection of navigation on the Kanawha River. Discussion of that letter with the executive secretary of the commission has left counsel for the company with the impression that the commission can not accede to the request of the company, in respect at least of the major points thereof.

The company is unwilling to surrender its property and constitutional rights to the extent of accepting a license such as the commission can or proposes to issue; yet it is desirous of commencing the construction of the project at the earliest possible date. Unless, therefore, it is feasible for the commission to
3189 issue a license the terms of which relate solely to naviga-

tion, the company proposes to proceed with the construction of the project without obtaining a license from the Federal Power Commission.

However, the company desires to make it clear that as regards the construction and operation of its proposed development, it is willing to accept all conditions which are reasonably designed to protect the navigability of the waters of the United States and, specifically, is willing to subscribe to; and at all times to be controlled by, any reasonable rules and regulations which the Secretary of War may prescribe in the interests of navigation.

The legal aspects of this case are exceedingly important from the standpoints both of prospective developers of water power on nonnavigable streams and likewise of the commission itself.

The company assumes that it is the policy of the commission to promote and to cooperate with legitimate business and developments of water power. Consequently it appears reasonable that the commission should seek and utilize opinions as to the legal phases of the problem from the Attorney General of the United States.

Under the circumstances, therefore, the company believes that it would be appropriate, and hereby respectfully and earnestly requests, that the commission obtain from the Attorney General of the United States an opinion on the pertinent points, including the following:

1. When under the Federal water power act

(a) A corporation has under section 23 made a declaration of intention;

(b) The commission, upon investigation, has found that the interests of interstate or foreign commerce would not be affected by such proposed construction;

(c) Permission is thereby granted by the commission to construct the project;

(d) At some later time, due either to the construction or operation of the project, there is created an obstruction to the navigable capacity of waters of the United States;

does there remain to the Federal Government a remedy to prevent or regulate the obstruction by proceeding against the company for a violation of the act of March 3, 1899 (30 Stat. L. 1151)?

2. With specific reference to all the facts in the case of Appalachian Electric Power Co., when in the case of a declaration of intention under section 23 of the Federal water power act, the Chief of Engineers of the Army finds in essence that it is problematical and at least uncertain whether the proposed project could or would adversely affect the interests of interstate or for-

eign commerce, may the Federal Power Commission lawfully make a finding that the project (positively) would affect (adversely) the interests of interstate or foreign commerce?

3. With specific reference to all the facts in the case of Appalachian Electric Power Co., the major facts of which are

(a) The company has made a declaration of intention under section 23 of the Federal water power act;

(b) The commission, upon investigation, has found that "the interests of interstate or foreign commerce would be affected by such proposed construction";

(c) The company has applied for a license;

(d) The commission has tendered to the company a draft of license which it proposed to issue to the company;

(e) The company thereupon has requested that the provisions of the license be limited to such as are reasonable, relevant and appropriate for the protection of navigation;

(f) The commission has notified the company that it can not or is unwilling to issue a license so limited;

in event the company should now proceed with the con-
3190 struction of the project without a license from the Federal Power Commission, what procedure against the company would then be legally and practically available to the commission and/or the War Department, with special reference to the Federal water power act of June 10, 1920, the act of March 3, 1899, and any other pertinent law?

4. When under section 23 of the Federal water power act a declaration of intention has been filed to construct a project in a stream other than one defined as "navigable waters" by the act, and upon investigation of the proposed construction it is found to be difficult to ascertain in advance and therefore not certain whether the interests of interstate or foreign commerce would be affected by such proposed construction, could the commission refrain from making any finding as to whether the proposed construction would or would not affect the interests of interstate or foreign commerce and thereby leave the jurisdiction of the project to the War Department under the act of March 3, 1899?

In case the commission or the Secretary of War should request such an opinion from the Attorney General, the company respectfully requests that, in certifying any facts of the case to the Attorney General, there be included the above-mentioned letter of the company to the commission dated March 1, 1928, and also that part at least of the letter of the Acting Chief of Engineers of the Army to the executive secretary of the Federal Power Commission, dated July 25, 1926, which reads as follows:

"4. I therefore report that there is reason to believe that in the future exceptionally dry seasons may occasionally occur during

which the proposed project near Redford, if unregulated, might adversely affect the navigable capacity of the Kanawha River."

Respectfully yours,

APPALACHIAN ELECTRIC POWER CO.,
By CURTIS, MALLET-PREVOST, COLT & MOSLE.

MARCH 1, 1928.

Hon. DWIGHT F. DAVIS, *Secretary of War;* Hon. HUBERT WORK, *Secretary of the Interior;* Hon. WILLIAM M. JARDINE, *Secretary of Agriculture*, constituting the Federal Power Commission, Washington, D. C.

Subject: Project 739, Virginia Appalachian Electric Power Co.

DEAR SIRS: The engineering and geological investigations which have been carried on for more than a year at the proposed dam and reservoir site for this project have progressed to the point where it seems advisable to consider the license which the Federal Power Commission proposes to issue to Appalachian Electric Power Co.

June 1, 1927, the Federal Power Commission took the following action on the declaration of intention filed by the New River Development Co.:

"In the matter of the declaration of intention, under the provisions of section 23 of the Federal water power act, of New River Development Co., a corporation organized under the laws of the State of Virginia, to construct a dam and other structures across and in New River in the vicinity of Radford, Pulaski County, State of Virginia, said dam and other structures being part of a power project proposed to be constructed for the purpose, inter alia, of the development and utilization of power, said declaration having been submitted to the commission under date of June 26, 1925: The commission having caused investigation of such proposed construction to be made and it appearing from such investigation and from reports submitted thereon that said project, unless operated in the interests of interstate or foreign commerce in accordance with the requirements of said act, would have an adverse effect on such interests, but if operated in accordance with such requirements would materially benefit such commerce, thereupon found that said river in the part thereof involved in said declaration is not 'navigable waters' within
3191 the definition thereof in said act, but that the interests of interstate or foreign commerce would be affected by such proposed construction."

This finding was made even though the project is located on the New River entirely within the confines of the State of Vir-

ginia and the nearest navigable waters, those of the Kanawha River to which the New River is tributary, are in the State of West Virginia and more than 150 miles downstream from the proposed power site.

The original declaration of intention was filed by the New River Development Co. June 26, 1925. In a letter dated September 2, 1926, addressed to the Federal Power Commission by Curtis, Mallet-Prevost, Colt & Mosle, attorneys for Appalachian Electric Power Co., there was inclosed a formal assignment to Appalachian Electric Power Co. of the declaration of intention filed by New River Development Co. In the same letter there was also inclosed an application by Appalachian Electric Power Co. for a license for the proposed project. This letter stated that the application for a license was submitted on the understanding that such application could be withdrawn if it should develop that a Federal license would not be required.

On July 1, 1927, the Federal Power Commission forwarded to the office of Curtis, Mallet-Prevost, Colt & Mosle, duplicate copies of the license which it is proposed to issue to this company for a power project in the New River near Radford, Pulaski County, Va.

After careful examination of the provisions of this proposed license, and upon advice of counsel, Appalachian Electric Power Co. has come to the conclusion that the proposed form of license in the present instance either is not authorized by a proper construction of the Federal water power act or, if the construction be proper, is predicated upon an act which is, at least in part, unconstitutional. Appalachian Electric Power Co. is advised that where a license is to be issued under section 23 of the act and where the project is located entirely on nonnavigable waters and utilizes no public lands of the United States, the commission is not authorized to insert in the license any provisions, whether specified by section 10 of the act or not, which go beyond what is reasonable and appropriate to protect the navigable waters of the United States.

The company is not in this case concerned with the validity of the act in so far as it may be applicable to projects on Government lands, upon navigable waters or in the organized territories of the United States. But the company submits that the only authority of Congress, and the only authority which would be deemed to be conferred validly upon the commission in this case, is to protect the navigable capacity of the waters of the United States and that the limit of the commission's power, if it has any power in the premises, is to impose conditions and regulations reasonable and appropriate for that purpose. The inser-

tion of any other provision is, in the company's judgment and in any view of the act, unauthorized or, if it could be deemed as specifically authorized, unconstitutional.

The company submits that the only possible interpretation of the Federal water power act which could in any view be regarded as consistent with its constitutional validity, and which would permit the commission to issue a license to it, would be that such a license should embody neither such provisions or conditions as those which are set forth in section 10 of the act and which have no bearing upon the protection of navigation nor the recapture provision of section 14 of the act. That is to say, the only valid requirement or authority for a license in this case would be for a license the provisions and conditions of which would insure protection of the navigable capacity of the Kanawha River.

Appalachian Electric Power Co. will accept a license containing conditions reasonably and appropriately designed for the protection of the navigable waters of the United States, but it can not accept a license containing terms which are beyond
3192 the authority of the commission to impose. The company submits that the tendered license contains many provisions wholly unauthorized by any admissible construction of the act in view of constitutional limitation.

In the light of the foregoing, the company desires to call the attention of the commission to certain provisions in the proposed license which has been tendered to Appalachian Electric Power Co.:

The last clause of the preamble and the granting clause found on page 3 of the proposed license are as follows:

"Whereas the licensee, on the day of ----------, pursuant to an authorization of its board of directors, a copy of the record thereof being hereto attached, accepted in writing all the terms and conditions of the act and of this license.

"Now, therefore, the commission hereby issues this license to the licensee for the purpose of constructing, operating, and maintaining certain project works necessary or convenient for the development and improvement of navigation and for the development, transmission, and utilization of power across, along, from, or in said New River and constituting a part of the project hereinafter described; said license, including the period thereof, being subject to all the terms and conditions of the act and of the rules and regulations of the commission pursuant thereto as amended and made effective on the 1st day of April, 1924, as though fully set forth herein, which said rules and regulations are attached hereto and made a part hereof and being subject also to the following express conditions and limitations, to wit:"

Under the proposed wording, the company would be required to place itself in a position where it might be urged that the company would be bound by all the terms and conditions of the act and of the proposed license; moreover, the license contains the statement that the license would be "subject to all the terms and conditions of the act and of the rules and regulations of the commission pursuant thereto." For reasons hereinbefore and hereinafter stated, the company can accept neither all the conditions of the act nor all the rules and regulations of the commission pursuant thereto nor all the conditions of the proposed license. The company is willing, however, to accept such conditions of the act, such rules and regulations of the commission, and such conditions of a license as are reasonable and appropriate for the protection of the navigability of the waters of the United States.

Article 1.—That part of article 1 which reads: "in consideration of such license and the benefits and advantages accruing thereunder to the licensee it is expressly agreed by the licensee that the entire project, project area, and project works as hereinafter designated and described, whether or not located in, on, or along said New River or upon lands of the United States, shall be subject to all the terms and conditions of the act and of the rules and regulations of the commission pursuant thereto and made a part of this license," the company is unwilling to accept. The commission in the present case has no authority to impose this condition, because it would mean, for example, that the company would thereby agree to the recapture provisions of section 14 of the act and other provisions clearly inappropriate and unconstitutional as applied to the project here involved.

Article 2.—It is not apparent that all the conditions of this article are reasonable and appropriate for or relevant to the protection of navigation. Nevertheless, the company raises no objection to this article.

Articles 3 to 5, inclusive.—To the extent that the requirements of these articles are reasonable and appropriate for or relevant to the protection of navigation, the company is willing to accept them.

3193 Article 6.—The company is willing to accept the conditions of this article.

Article 7.—The terms of this article appear to go beyond that which is reasonable and appropriate for the protection of navigation. Nevertheless, the company is willing to accept this article, provided there be omitted from the fourth sentence thereof, the following: "and the ownership or possession, or the right of use and occupancy, of which are subject to acquisition by the United States under the provisions of section 14 of the act."

The company submits that any conditions providing for or referring to the recapture of this project by the United States are wholly unauthorized by the act and beyond the constitutional power of Congress.

Articles 8 to 12, inclusive.—The company is willing to accept the conditions of these articles.

Articles 13, 15, and 16.—Those conditions of these articles which pertain to navigation facilities appear to be relevant only in the case of a project located on a navigable stream, but in the present case, inasmuch as New River in the part thereof involved in this proposed project is not navigable, appear to be irrelevant, inappropriate, and unauthorized. Nevertheless, the company is willing to accept the said conditions.

Article 14.—The company is willing to accept any conditions which are reasonably designed to protect the navigability of the waters of the United States. However, there are certain conditions in this article which appear not to fall in that category.

The first condition of the article, namely: "The United States specifically retains and safeguards the right to use water in such amount to be determined by the Secretary of War as may be necessary for the purposes of navigation," appears to be relevant only in the case of a project on a navigable stream, and therefore, in the present case, appears to be irrelevant, inappropriate, and unauthorized. Nevertheless, the company is willing to accept the said condition.

The company is willing to accept the condition that "the operations of the licensee so far as they affect the use, storage, and discharge from storage of waters affected by this license shall at all times be controlled by such reasonable rules and regulations as the Secretary of War may prescribe in the interests of navigation."

However, the company wishes to point out that the condition reading: "Provided, That the licensee shall discharge at least 9,000 acre-feet of water per week over or through the dam, and whenever the flow at Lock No. 2, Kanawha River, falls below 1,400 cubic feet per second, the licensee shall, unless otherwise authorized by the Secretary of War, discharge in each 24 hours the natural flow of the river entering the reservoir during the same period, such weekly and daily discharges being subject to the reasonable rules and regulations hereinbefore mentioned," seems unreasonable and more stringent than the needs of navigation require.

The condition that "the operations of the licensee, * * * shall at all times be controlled by such reasonable rules and regulations * * * as the Federal Power Commission may

prescribe in the interests of flood control" is construed by the company as having reference merely to the protection of navigation and a license containing this condition would be accepted only with such understanding.

The condition of this article in which there is an attempted reservation of authority in the commission to prescribe rules and regulations in the interest "of the fullest practicable use of said waters for power purposes" appears to be irrelevant, 3194 inappropriate, and unauthorized for the protection of navigation. However, inasmuch as the company is in sympathy with any requirement which will provide for the fullest practicable use of the river for power purposes, it is willing to accept the said condition of this article.

Article 17.—The company, like the commission, is desirous that the higher portions of the reservoir area be properly cleared and hence is willing to accept the conditions of this article.

Article 18.—The company can not accept the conditions of this article. It is advised that the commission has, under the circumstances, no authority to impose such conditions and earnestly submits that they should be omitted from any license which the commission issues for this project.

Article 19.—Although the company is advised that there is doubt as to the authority of the commission to require such conditions in a license for this project, the company is sympathetic with the principle that there should be compensation for beneficial storage and hence is willing to accept the conditions of this article.

Article 20.—The company is willing to accept the conditions of this article, but it is suggested that the technical determination of the power capacity be discussed between the engineers of the commission and those of the company. In passing, however, it is desired to point out that the second item of charge specified in the first sentence of this article is irrelevant and without application for the reason that no "lands or other property" of the United States are involved in the project.

Article 21.—The company can not accept the provisions of this article. It is advised that the commission has, under the circumstances, no authority to impose such conditions and earnestly submits that they should be omitted from any license which the commission issues for this project.

Article 22.—The company is willing to subject itself to such of the conditions of this article as are necessary and appropriate for the protection of navigation, but is unwilling to accept such a condition as that which requires that any lease which it may make of the project property shall be subject to "all the condi-

tions of * * * the act and of said rules and regulations of the commission."

Article 23.—The company is willing to subject itself to such of the conditions of this article as are reasonable and appropriate for the protection of navigation, but is unwilling to accept any conditions which are not reasonable or appropriate for the foregoing purpose and instead are predicated upon and refer to the so-called recapture provisions of sections 14 and 15 of the act.

Article 24.—The company is willing to accept that part of article 24 which reads:

"The licensee shall abide by such reasonable regulation of the services to be rendered to customers or consumers of power, and of rates and charges of payment therefor, as may from time to time be prescribed by any duly constituted agency of the State in which the service is rendered or the rate charged."

The rates and services rendered by the company are at this time being regulated by the State of Virginia, and the power of the State to do so has never been doubted. The remainder of article 24 the company is unwilling to accept, for the reason that the commission has no authority to regulate the services, rates, 3195 or securities of this company, whether or not the State should have a commission or other authority for such regulation and control.

Article 25.—The company is willing to accept the conditions of this article.

Article 26.—The company objects to any implication that in accepting a license (in the modified form as proposed herein) it would accept also such provisions of the act and such rules and regulations of the commission as are not relevant, appropriate, or authorized for the protection of navigation.

Despite the foregoing enumeration of specific provisions of the tendered license to which the company has objection, it desires to assure the commission that it is willing to accept every provision which may be reasonable and appropriate for the protection of the interests of the Federal Government in the navigable waters of the United States. At the same time the company insists that there shall be eliminated from the license provisions which are unreasonable and inappropriate to that end. The company trusts that the commission will be willing to cooperate with it and is therefore desirous that it be informed by the commission which, if any, of the objectionable provisions the commission is willing to eliminate, in order that the company may consider the tendered license as modified by such eliminations.

This communication and the expression of the company's willingness to accept a license upon the terms which have been stated are without prejudice to the company's right, in case this proposal is not accepted, to urge the invalidity of the authority claimed by the commission upon any and all grounds including the construction or constitutionality of the act.

Respectfully yours,

APPALACHIAN ELECTRIC POWER CO.,
By CURTIS, MALLET-PREVOST, COLT & MOSLE.

After discussion, it was voted that reference of such questions to the Attorney General would not be appropriate and that the commission was of the opinion that modification of the form of license as requested in the letter of March 1 would be in violation of the provisions of the Federal water power act.

At 11.30 a. m. the meeting was adjourned.

O. C. MERRILL, *Executive Secretary.*

3196 FISCAL YEAR ENDED JUNE 30, 1931

3197 One hundred and eighth meeting held in the office of the Secretary of the Interior, November 25, 1930

Meeting called to order at 4.10 p. m.

Present: Secretary Wilbur, acting chairman; Secretary Hyde, member of the commission; F. Trubee Davison, Acting Secretary of War, acting member of the commission; F. E. Bonner, executive secretary; Lieut. Col. M. C. Tyler, chief engineer; J. F. Lawson, acting chief counsel; Chas. A. Russell, solicitor; Maj. F. K. Newcomer, assistant chief engineer; E. C. Bebb, F. F. Henshaw, N. B. Keeler, and R. R. Randell, engineers; Maj. R. Y. Stuart, forester, United States Forest Service; B. F. Heintzleman, assistant regional forester, Alaska,

The executive secretary presented a list of 22 applications, Nos. 863 and 1113 to 1133, inclusive, received since the meeting of August 27, 1930.

* * * * *

Authorizations for licenses

The executive secretary presented applications for licenses, with reports and recommendations thereon, upon which action was taken as follows:

1. The executive secretary stated that a minor-part license application of the Appalachian Electric Power Co. for a development near Radford on New River, a nonnavigable stream, project 739, Virginia, was ready for consideration and that in accordance with the opinion of the Attorney General of September 22, 1930, the commission has full authority to exercise its dis-

cretion in waiving certain provisions under section 10 (i) of the act in connection with any license issued in this case.

After due consideration the commission declined to take action on the application, favorable or adverse. It was concluded that in view of the importance of the questions of jurisdiction as between the United States and the State of Virginia involved in this case a court adjudication is desirable.

One hundred and fifteenth meeting, January 26, 1931

Present: Commissioners Draper, Garsaud, McNinch, Williamson, and Chairman Smith.

Discusssion—Application of Appalachian Electric Power Co.

Col. F. W. Scheidenhelm and Mr. Graham Claytor, representing the Appalachian Electric Power Co., having application for a power project, No. 739, on the New River, appeared before the commission informally urging early action and decision upon their application for a minor-part license.

These gentlemen briefly surveyed the history of their efforts to procure a license and stated that approximately $1,750,000 had been expended in the preliminary work on New River in rebuilding roads, purchasing lands, establishing quarters, and for engineering expenses, and that no further progress could be made until the Federal Power Commission had definitely decided its position in regard to the application.

Reference was made to previous information furnished by Mr. William E. Carson, chairman of the Virginia State Commission on Conservation and Development, to the effect that one
3198 town in the vicinity of this work, and within 3 or 4 miles of the proposed construction, was at the present time, and had been for some weeks, feeding at public expense 500 families; that deaths are actually occurring in the vicinity due directly or indirectly to the inability of the community to care for the people who are out of employment; that the construction work on this project would relieve that situation; and that action upon the application, even through it were adverse to the company's request for license, would improve local conditions.

Individual members of the commission expressed their realization of the importance of early action on the application, but expressed also the opinion that the decision in this case involved so fundamentally the underlying principles of interpretation of the Federal water power act that any action upon the part of the commission would act as a precedent guiding the future acts of the commission and, therefore, due to the extreme importance of the legal questions involved, expressed the view that

a public hearing should be had at which time the attorneys for the power company, of any State interested, or any other interested party, would have an opportunity to present, either upon written brief or orally, or both, any arguments which they might desire involving the interpretation of the Federal water power act affecting the granting of minor-part licenses or affecting the jurisdiction of the Federal Power Commission.

It was the consensus of opinion that such hearing, if had, should be held at as early a date as possible and was tentatively set for Monday, February 16, 1931, subject to change at the convenience of the parties interested.

One hundred and sixteenth meeting, January 28, 1931

Present: Commissioners Draper, Garsaud, McNinch, Williamson, and Chairman Smith.

Order for public hearing

The following order was unanimously approved:

It is hereby ordered that a public hearing be held before the Federal Power Commission at 10 a. m., room 5243, Interior Building, February 16, 1931, at which time parties interested can present by oral argument or written brief, or both, any arguments touching upon the request for a license now pending before the Federal Power Commission by the Appalachian Electric Power Co. in connection with its proposed power development upon New River, Va.

It is further ordered that notice of this hearing be immediately sent by wire to the Appalachian Electric Power Co. and also to the governors of the following States who have registered with the commission by letter indications of their interest in this question: Virginia, West Virginia, Tennessee, and Akransas.

One hundred and twenty-third meeting, February 25, 1931

Present: Commissioners Draper, Garsaud, McNinch, Williamson, and Chairman Smith.

The chairman reported that Mr. Judson King had informally requested extension of time for filing his brief in the New River case.

It was voted that Mr. King be told that as February 28 is the limit fixed for the filing of briefs and it is now too late to notify other interested parties of any extension of time, no formal extension is possible, but that his brief will be considered by the commission when received.

3199. One hundred and twenty-sixth meeting, March 10, 1931

Present: Commissioners Draper, Garsaud, McNinch, Williamson, and Chairman Smith.

The chairman reported that supplemental briefs following the public hearing on project 739–Virginia were received before the close of business February 28 from the Appalachian Electric Power Co. by Curtis, Mallet-Prevost, Colt & Mosle; the State of Pennsylvania, by Geo. W. Woodruff, personal counsel to Governor Pinchot, concerning utility matters, and the State of Virginia, by William E. Carson, chairman Virginia Conservation and Development Commission; also, that the brief submitted by Judson King, as director of the National Popular Government League, was received on March 9, the other brief, purporting to come from the same organization and received on February 25, having immediately thereafter been declared by Mr. King as unauthorized and mailed through inadvertence.

One hundred and thirty-fourth meeting, April 3, 1931

Present: Commissioners Draper, Garsaud, McNinch, Williamson, and Chairman Smith.

Opinion and order

In the matter of the Appalachian Electric Power Co., project No. 739, Virginia:

On June 26, 1925, the New River Development Co., predecessor of the Appalachian Electric Power Co., filed a declaration of intention to construct a proposed dam and power project on New River near Radford in the State of Virginia. The declaration of intention was filed under the provisions of section 23 of the Federal water power act (41 Stat. 1063).

On September 2, 1926, the successor company filed formal application for a license for said project, "upon the understanding that such application can be withdrawn if it should develop that a Federal license is not required."

Pursuant to hearings held by the commission on March 2, 1926, and on October 28, 1926, at which time evidence was introduced by the interested parties, the Federal Power Commission, on June 1, 1927, adopted and entered in its minutes the following order:

"In the matter of the declaration of intention, under the provisions of section 23 of the Federal water power act, of New River Development Co., a corporation organized under the laws of the State of Virginia, to construct a dam and other structures

across and in New River in the vicinity of Radford, Pulaski County, State of Virginia, said dam and other structures being part of a power project proposed to be constructed for the purpose, inter alia, of the development and utilization of power, said declaration having been submitted to the commission under date of June 20, 1925; the commission having caused investigation of such proposed construction to be made and it appearing from such investigation and from reports submitted thereon that said project, unless operated in the interests of interstate or foreign commerce in accordance with the requirements of said act, would have an adverse effect on such interests, but if operated in accordance with such requirements would materially benefit such commerce, thereupon found that said river in the part thereof involved in said declaration is not 'navigable waters' within the definition thereof in said act, but that the interests of
3200 interstate or foreign commerce would be affected by such proposed construction."

And, pursuant to said order, on July 1, 1927, tendered to the said applicant a license in standard form.

On February 4, 1930, the applicant company, having previously refused said license, requested the commission to reconsider the finding as made to the effect that the proposed project would affect the interests of interstate or foreign commerce, or in the alternative to issue a minor-part license for this project.

On October 6, 1930, the applicant company applied to the Federal Power Commission for a minor-part license for this project.

On November 25, 1930, the minutes of the Federal Power Commission at it final meeting prior to its reorganization show that—

The executive secretary stated that a minor-part license application of the Appalachian Electric Power Co. for a development near Radford on New River, a nonnavigable stream, project No. 739, Virginia, was ready for consideration, and that in accordance with the opinion of the Attorney General of September 22, 1930, the commission has full authority to exercise its discretion in waiving certain provisions under section 10 (i) of the act in connection with any license issued in this case.

After due consideration the commission declined to take action on the application, favorable or adverse. It was concluded that in view of the importance of the questions of jurisdiction as between the United States and the State of Virginia involved in this case a court adjudication is desirable.

The present Federal Power Commission, organized on December 22, 1930, set a hearing on the matter, and, on February 16 and 17, 1931, the applicant appeared and was duly heard and filed brief.

At the same time Hon. E. Lee Trinkle, for the region in which project is proposed to be constructed in Virginia; William E. Carson, Esq., chairman, Virginia Conservation and Development Commission; E. W. Caffee, Esq., mayor of Pulaski, Va.; F. M. Livezey, Esq., for Public Service Commission of West Virginia; C. R. Luker, Esq., representing Governor of Kentucky; Hon. Roy H. Beeler, representing State of Tennessee; Hon. John H. Caldwell, assistant attorney general of Arkansas; and Hon. Edwin H. Gibson, assistant attorney general of Virginia, appeared and several of said parties submitted briefs in support of the protests of their respective States theretofore filed with the Federal Power Commission objecting to the said commission taking jurisdiction on the said application.

Also there were filed with the commission briefs by George W. Woodruff, personal counsel to Hon. Gifford Pinchot, Governor of the State of Pennsylvania, and by Herbert S. Ward and other counsel for the National Popular Government League in support of the jurisdiction of the commission in the specific instance covered by this application and like instances.

Commissioner McNinch proposed, and Commissioner Draper supported, such proposal, that this commission should reconsider and reverse the finding of the former commission, "that said river in the part thereof involved in said declaration of intention is not 'navigable waters' within the definition thereof in said act."

The majority of the commission is of the opinion that the suggestion does not involve the question of the jurisdiction of this commission over New River, but merely the question of the ground upon which such jurisdiction shall be predicated, and that the ultimate determination of what is "navigable waters" under the Federal water power act in any case is one for the courts and that any finding made by this commission as to what are navigable waters in law would not be binding upon the courts.

It is the judgment of a majority of the commission, in view of the conflicting evidence and opinion as to New River being "navigable waters within the definition of the act," that jurisdiction is more properly based upon section 23 of the act,
3201 applicable to streams of this character where the authority of the commision is clearly defined, leaving to the

courts the determination of the question of "navigable waters as defined in the act."

It is the unanimous opinion of the commission that the evidence clearly sustains the finding that the proposed construction would affect the interests of interstate and foreign commerce. New River is the principal tributary of the Kanawha River and as such in low-water periods supplies the principal part of the flow of the Kanawha River, a navigable stream presently used in interstate and foreign commerce, and the Kanawha River is one of the principal tributaries of the Upper Ohio River, a navigable stream presently used in interstate and foreign commerce. These facts, together with others in the record, support such finding. It is the opinion of this commission that such finding when so based upon valid evidence is conclusive in view of the authority conferred upon this commission by section 23 of the act.

Now, therefore, this commission having reviewed the evidence, records, and files of this office, bearing upon the issues hereinbefore set forth, having heard argument and carefully read the briefs above referred to, and being fully advised in the premises, hereby orders:

1. That the motion of the applicant company to reconsider the finding of June 1, 1927, "that the interests of interstate or foreign commerce would be affected by such proposed construction" be, and the same is hereby, denied;

2. That the application, dated October 6, 1930, for a minor-part license for this project be, and the same is hereby, denied; and

3. That the applicant shall be tendered a standard form license under the act, and it is hereby ordered that it shall not proceed with construction until it shall have received and accepted such license.

Approval of form of license

Commissioner McNinch submitted a form of license for the Appalachian Electric Power Co., project 739–Virginia, and moved its adoption. The motion to adopt was seconded by Commissioner Williamson and approval of the form was unanimously voted.

Commissioner Garsaud was of the opinion that the full text of the findings of the commission of June 1, 1927, should be inserted in the license.

One hundred and fifty-first meeting, May 5, 1931

Present: Commissioners Draper, Garsaud, McNinch, Williamson, and Chairman Smith.

3203 Two Hundred and Third Meeting, October 26, 1931

Present: Commissioners Draper, Garsaud, McNinch, and Chairman Smith.

Resolution

On motion of Commissioner Draper, the following resolution was unanimously adopted:

Resolved, The commission by letter of October 21, 1931, having authorized the Attorney General to raise the issue of navigability of New River in the Appalachian Electric Power Co. case and Assistant Attorney General Seth W. Richardson in a letter to the commission dated October 23, 1931, having requested the commission to proceed without delay in obtaining available evidence upon this issue, the commission hereby delegates to Commissioner McNinch the duty of cooperating with the Department of Justice in discovering and preparing in usable form all evidence obtainable for presentation to the court in support of the Government's contention and in the performance of this task Commissioner McNinch is authorized to use such portion of Acting General Counsel Lawson's time as may be found necessary and all or such part of the time of Attorney Gatchell as he may think necessary. If further assistance is deemed necessary by him from time to time he shall make know such further requirements to the commission with his recommendations in regard thereto.

A Declaration of the Navigability of New River

(Project No. 739)

On October 12, 1932, the following resolution, offered by Commissioner McNinch, and seconded by Commissioner Draper, was adopted by unanimous vote:

Whereas, it has been brought to the attention of the Federal Power Commission that plaintiff, in its brief and on oral argument in the United States District Court before Mr. Justice Luther B. Way, at Norfolk, Va., on July 19, 1932, in the case of the Appalachian Electric Power Co. against George Otis Smith et al., Equity No. 494, stated that the defendants, as members of the Federal Power Commission, did on April 3, 1931, reaffirm and adopt a finding of the predecessor commission dated June 1, 1927, that New River was nonnavigable; and

Whereas it appears from said brief and oral argument of plaintiff's counsel that the position and action of this commission in respect to the said finding of June 1, 1927, by a predecessor commission of the nonnavigability of New River has been misunderstood and the purpose and effect of the action taken by this commission on April 3, 1931, has been construed by plaintiff's counsel contrary to the intent and understanding of this commission of its said action, and this commission desiring to correct such misinterpretation and misunderstanding and to clarify its position in regard thereto;

Does hereby declare that neither this commission, as constituted on April 3, 1931, nor the members of the commission, by the action taken on said April 3, 1931, either adopted or reaffirmed, or intended its action to be understood or interpreted as an adoption or reaffirmation of the finding of the predecessor commission on June 1, 1927, to the effect that New River was nonnavigable, but that on the contrary, as the record of this
3204 commission's action plainly shows, this commission made no finding as to the navigability or nonnavigability of said New River, as it was of the opinion that it was not required to make any finding upon such question;

That, as a further evidence that this commission did not adopt or reaffirm the finding of nonnavigability of New River by the predecessor commission on June 1, 1927, and did not intend that its action taken April 3, 1931, should be so construed, this commission after plaintiff's bill had been filed did on October 21, 1931, by letter to the Attorney General of the United States authorize the Attorney General to submit the question of the navigability of New River to the courts and expressed its readiness to furnish the Attorney General with such facts and evidence as are obtainable upon this question; that pursuant to authority given in said letter, the first answer of the members of the commission traversed the allegation of plaintiff company to the effect that the present commission had reaffirmed and adopted the finding of the predecessor commission that New River was nonnavigable; and the second answer of the members of the commission averred that said river is navigable, which averment of navigability had the approval of this commission and the members thereof;

And this commission further declares that, in view of the misunderstanding and misinterprtation of the action taken by this commission on April 3, 1931, and of the authority subsequently given to the Attorney General to submit the question of the navigability, of the New River to the courts, and of the answers filed by the Attorney General on behalf of the commission and the

members thereof, and upon the whole record and evidence before the commission in this matter on April 3, 1931, including the doctrine of navigability as laid down in numerous cases by the United States Supreme Court, and the records of surveys of New River authorized by Congress, appropriations by Congress for the improvement of New River, official reports to Congress recommending improvement of New River, reports of improvements made upon said river, the report of the Board of Engineers appointed to examine the James River and the Kanawha Canal project, reports by the Chief of Engineers relative to the navigability of New River and the effect of the proposed project on interstate commerce; also reports by the Secretary of War and the Chief of Engineers on the survey of New River, the report of Moore and Briggs upon the survey and navigability of said river, the acts of Congress authorizing construction of dams across New River, permits by the Secretary of War for construction of bridges across said river, and numerous statutes by the States of Virginia and West Virginia recognizing the navigability of the said river;

The commission finds and declares that New River, from the mouth of Wilson Creek, Va., north, is navigable waters within the definition thereof, as set forth in section 3 of the Federal water power act.

Commissioner Williamson concurring:

The action of the commission on April 3, 1931, as given in its written decision, was designed to express the fundamental basis upon which Federal jurisdiction was predicated.

The commission by that action took jurisdiction over New River for the purposes of the Federal water power act. This jurisdiction having been declared and the provisions of the Federal water power act made operative upon the applicant, the commission action was complete, regardless of the reasons given as justification therefor.

Thereafter, action was instituted by the applicant company, after refusal of the tendered license, questioning the jurisdiction of the United States in the premises.

The statement of the former commission, "that said river in the part thereof involved in said declaration is not 'navigable waters' within the definition thereof in said act," can not, in my opinion, be considered as a finding of fact. It was in form, as well as content, merely a conclusion of law. In fact, the present com-
3205 mission did not consider such finding as one of fact, nor pertinent to the decision of the case, and as not binding upon the courts.

Economy Light & Power Co. v. United States, 256 U. S. 113.

No attempt was made by this commission to pass upon the question of navigability in fact of New River, nor in my opinion was the question of navigability of New River necessarily before either the former commission, or this commission, the statute having been engaged upon a Declaration of Intention by the applicant company filed pursuant to the provisions of section 23 of the act.

The question was as to whether interstate and foreign commerce was affected. Prior to the passing of the Federal water power act the power to make this determination vested exclusively in Congress and its exercise was a function of that body.

Congress has the supreme power to regulate commerce with foreign nations, and among the several States, and with the Indian tribes by virtue of clause 3, section 8, Article I of the Constitution of the United States, and its declarations as to what is or is not necessary to its exercise of this power are beyond the jurisdiction of the courts to question.

In section 23 of the act this power is delegated to the Federal Power Commission, and in the exercise of that authority its decision, lawfully made, as to what will or will not affect interstate commerce, is subject to the same conclusiveness as pertains to Congressional action.

In the instant case there was evidence in the record supporting the commission's finding that the proposed project would affect interstate and foreign commerce and this is sufficient, in my opinion, to protect the finding of the commission against attack.

Crowell v. Benson, 285 U. S. 22.

It not only gives to the commission ample ground upon which to assert its jurisdiction, regardless of navigability in fact, but brings that determination within the body of decision law defining the dignity of such administrative action.

This being the view of the commission, the decision of April 3, 1931, should not be construed as a finding for or against navigability in fact of New River, nor can the existence of the finding of the former commission on June 1, 1927, be legitimately construed as an indication of this commission's view upon the question of navigability in fact.

It was my opinion then, and it is my opinion now, that the ground stated by this commission on April 3, 1931, is not only the strongest legal position the Government can take in support of the jurisdiction of the Federal water power act in this particular case, but is otherwise advantageous to the Government's interest. However, that New River has been navigated and that it is navigable water within tests applied by the court in many cases is clear.

The commission having asserted its jurisdiction and its position now being apparently misunderstood, the issue of navigability so far as it is pertinent to the Government's position should not, in

my opinion, be encumbered by any misunderstanding or misconstruction of this commission's former action.

For these reasons I concur in this action.

3206 *Government exhibit No. 92*

1925, Aug. 20—Report of General Taylor, Chief of Engineers on Declaration of Intention for project No. 739.

3207 WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
*Washington, August 20, 1925.*

Refer to File No. 7495 (New River Developt. Co.)—3

THE EXECUTIVE SECRETARY,
*Federal Power Commission,*
*Washington, D. C.*

DEAR SIR: 1. In reply to your request of July 1, 1925, the following report is submitted on the declaration of intention by the New River Development Company, to construct a power development in the New River, Va., near the town of Radford, Pulaski County, Va.

2. New River rises in the northwestern corner of North Carolina, near the Tennessee line, and flows northeasterly through and between spurs and branches of the Blue Ridge until it reaches the lead mines in Wythe County, Va. From this point it flows in the same general northeasterly direction between and parallel to the main divides of the Blue Ridge and the Alleghenies, cutting alternately through spurs, from the one to the other, until in the fifty-fifth mile of the survey at what is known as the Horseshoe, it turns abruptly to the northwest and breaks through the five ranges into which the Alleghenies are here divided, keeping the same direction to the mouth of the Greenbrier, 73 miles beyond.

3. Commencing at the lead mines with a width of 350 feet and an average depth of 5 feet, the river gradually expands to a width of 900 feet and an average depth of 6 feet, just above the Greenbrier, subject to expansions and contractions normally found in natural watercourses.

4. On its course, between the lead mines and the Greenbrier, New River receives several tributaries of varying size. Among them in the east are Big Reed Island and Big Stony Creeks and Little and Indian Rivers; on the west, Cripple, Reed, Walker's, and Wolfe Creeks and East and Blue Stone Rivers. All of these are mountain streams, furnishing from 50 to 200 c. f. s. of water at ordinary stages.

3208 5. (a) The original project was adopted in 1876, and provided for improving the stream from the Lead Mines in

Wythe County, Virginia, to the mouth of the Greenbrier River in West Virginia, by widening the channel from 30 to 50 feet as might be required, deepening it to two feet and straightening as needed for bateau navigation, the improvement however, to be made in such manner as would aid the work should greater depth and width be required in the future. The sum of $109,691.06 was expended up to June 30, 1898, for open river navigation.

(b) The declaration of intention involves the so-called New River bridge or Middle Division.

(c) Moore & Briggs, in 1819, surveyed 54 miles of the river between Sinking Creek and Greenbrier River under the auspices of the Board of Public Works of the State of Virginia. In their report the statement appears that "not withstanding it was represented to us as being remarkably low it afforded (July, 1819) a superabundance of water for every purpose of internal navigation." They also stated they ascended all the principal falls with their boat.

6. In the report submitted by Major W. P. Craighill, covering a distance of 128 miles of the river, dated Baltimore, Md., December 17, 1872, observations and measurements during unusually low water stages indicated a discharge at the dam of the Wythe Union & Lead Company in Wythe County, Va., of 2,000 c. f. s. and 3,000 c. f. s. at Sifford's Falls, 65 miles downstream, which the report states would indicate that the stream affords abundant water at all seasons for any scheme of navigation improvement that might be adopted.

7. On page 915, Annual Report, Chief of Engineers, for 1882, the following statement appears:

Miles of River Improvement

| | 1881 | Previous | Total |
|---|---|---|---|
| Greenbrier Division | 9 | 17½ | 26½ |
| New River Bridge Division | 10 | 12 | 22 |
| Lead Mines Division | 5⅓ | 0 | 5⅓ |
| | 24⅓ | 29½ | 53⅚ |

3209 8. The amount expended during the fiscal year 1881-82, exclusive of outstanding liabilities July 1, 1882, was $28,398.07 (See page 919, Annual Report, C. of E., 1882). On page 702, Annual Report, C. of E., 1883, the following is taken from the report of Lieut. Col. W. P. Craighill, dated Baltimore, Md., May 21, 1883:

Greenbrier, or Lower Division.....Improved 26½ miles.
New Bridge, or Middle Division.....Improved 29¼ miles.
Lead Mines, or Upper Division.....Improved 5⅓ miles.

9. At the close of the working season of 1882 there was a channel 50 feet wide and 2 feet deep from Hinton Landing to Wiley's Shoals, a distance by river of 26½ miles; also a channel from New River bridge to the head of Jones Ford, a distance of 21 miles as follows:

| | | | | | | |
|---|---|---|---|---|---|---|
| 12 | miles, | 30 | feet | wide, | 2½ | feet deep |
| 2½ | " | 20 | " | " | " | " |
| 7½ | " | 10 | " | " | " | " |

This channel was extended same year 8½ miles above the bridge.

10. Page 236, Annual Report, C. of E., for 1890, the following statement appears regarding the three sections under improvement: "The amount expended in the year ending June 30, 1890, has been $6,394.45 and the total to that date is $109,733.21."

11. On page 506, House Document No. 1491, 63rd Congress, 3rd Session, are found the following data on appropriations for River and Harbor improvement on New River, Va., and West Va.:

| | |
|---|---|
| August 14, 1876 | $15,000 |
| June 18, 1878 | 15,000 |
| March 3, 1879 | 12,000 |
| June 14, 1880 | 24,000 |
| March 3, 1881 | 24,000 |
| October 2, 1882 | 12,000 |
| October 5, 1886 | 10,000 |
| Total | $112,000 |

12. On page 5, House Document No. 1410, 62nd Congress, 3rd Session, the following statement appears: "From Hinton to the vicinity of Glenlyn, a distance of 30 miles, a boat drawing 2 feet will have sufficient depth of water for navigation at practically all times," and on page 6 of same document "From Hinton to Glenlyn, * * * there is some commerce, consisting of lumber, staves, sand, gravel, and also some grain, hay, farm
3210 products, and miscellaneous merchandise."

13. Commerce on the New River during the calendar year 1882 was reported as more than 11,000 tons. Commerce on the Kanawha River, of which the New River is the most important tributary, is reported as follows:

| Year | Tons | Value | Passengers | Floated timber[1] | |
|---|---|---|---|---|---|
| | | | | Tons | Value |
| 1919 | 892,253 | $12,138,677 | 2,267 | 312 | $7,488 |
| 1920 | 1,451,084 | 9,304,983 | 1,105 | 273 | 2,138 |
| 1921 | 1,118,691 | 8,778,335 | 2,768 | 220 | 1,980 |
| 1922 | 942,451 | 8,746,201 | 2,235 | 157 | 1,498 |
| 1923 | 1,572,821 | 7,828,786 | 3,262 | 15 | 135 |

[1] The tonnage and value of floated timber are not included in the amounts shown in Columns 2 and 3.

14. Hinton is in West Virginia, while Glenlyn is in Virginia, the New River therefore constituting an interstate stream so far as navigation is concerned. The proposed project involves falls, shallows and rapids which would probably compel land carriage.

15. The low water flow of the Kanawha at its junction with the Ohio is estimated as little, if any, less than the flow of the Ohio at the same point.

16. The River and Harbor Appropriation Act of June 13, 1902, repealed the previous acts providing for prosecution of work of improvement of New River, and directed that unexpended funds be paid into the Treasury of the United States. Congress has asserted jurisdiction over the New River in the past by having expended moneys on this stream for channel improvement with the view to improving the entire stream for navigation. Four proposed power developments on New River have been projected since the enactment of the Federal Water Power Act and have been considered as coming within the jurisdiction of the Federal Power Commission. They are—

Project No. 223 W. Va.—Preliminary permit granted to Charles B. Hawley, Washington, D. C., for power development at Sandstone Falls about 90 miles below the proposed project. This permit expired November 5, 1924.

Project No. 379 W. Va. and Va.—Preliminary permit granted the West Virginia Power Company, Charleston, W. Va., for power development at the mouth of the Bluestone River, about 79 miles below the proposed project. This permit is still in force.

3211 Project No. 542 N. C.—Application submitted and pending for preliminary permit for power development on the New and Reddies Rivers in North Carolina about 100 miles above the proposed project.

Project No. 575 Va. and N. C.—Application submitted and pending by the Eastern States Development Company, Wheeling, W. Va., for power development on the New River in Virginia, and the Fisher River in North Carolina, about 50 miles above the proposed project.

17. A. (a) This river is one of the principal tributaries of the Kanawha River, which has been improved for about 90 miles by the construction of [illegible] locks. It is really the Kanawha River under another name and the flow if not properly regulated could have an adverse effect on navigation during low water stages in the Kanawha River.

(b) The possible adverse effect is not such as to warrant refusal to allow the proposed construction to proceed if control is maintained by the United States.

(c) No action by any other agency of the United States will be necessary or desirable to protect fully the interests of interstate or foreign commerce.

B. (a) Proper regulation of the flow of the river would naturally be of benefit to navigation. The extent of this benefit has not been fully determined.

(b) To fully protect the interests of interstate or foreign commerce any license granted should be made subject to the following conditions:

1. That the licensee shall permit a continuous flow past its dam not less than the low water flow of the stream as determined by the records of the stream gauging stations required by the preliminary permit, subject to such modifications as the Secretary of War may prescribe in the interests of navigation, and shall not at any time interfere with the natural flow of the river to such an extent as to interfere with or impede navigation.

2. That the operations of the licensee, so far as they affect the use, storage and discharge of the river shall be controlled by such reasonable rules and regulations as the Secretary of War may prescribe in the interests of navigation.

18. From the above facts it is established that New River has been under Federal improvement for navigation, that navi-
3212 gation has actually existed and that the river was physically capable of interstate navigation although very light draft. The fact that navigation does not exist at present is not understood to change the legal status of the stream. Congress has in the past signified its intention to assert jurisdiction of the New River by appropriating money for its improvement with a view to making the stream navigable, and it is not seen that the fact that the reversion to the Treasury of unexpended funds was later ordered alters its status. If free from any control by the United States it would be difficult to ascertain authoritatively that the proposed development would be in general accord with the most beneficial utilization of the water for navigation, water power, flood control and other beneficial public uses. It is obvious that such utilization is essential to the best interests of commerce. Therefore, while the navigable capacity of the stream is limited, this office must report that no sufficient reason is seen why the Federal Power Commission should not exercise jurisdiction over the proposed project.

Very respectfully,

(Signed) H. TAYLOR,
*Major General, Chief of Engineers.*

*Government exhibit No. 93*

1925, July 23—Report of District Engineer, Major A. K. B. Lyman and Endorsement (7/25/29) Division Engineer C. W. Kutz, on declaration for project No. 739.

3214

WAR DEPARTMENT,
UNITED STATES ENGINEER OFFICE,
13TH FLOOR, COAL EXCHANGE BUILDING,
*Huntington, West Virginia, July 23, 1925.*

Refer to File No. M668

Subject: Report on declaration of intention dated June 25, 1925, by the New River Development Company for proposed water-power development in the New River near Radford, Virginia.

To: The Chief of Engineers, U. S. Army, Washington, D. C. (through the Division Engineer, Central Division).

1. Improvements for navigation.—(a) Improvement for navigation have been made on the New River extending from Hinton, West Virginia, to a distance upstream for about twenty-five miles. About $110,000 was expended on the work. The last work was done in 1882, except the expenditure of $10,000 since that date.

(b) Surveys and examinations were made but no improvements on that part of the river involved in this declaration of intention.

(c) The improvements made for navigation in the New River consist of building channel chutes or sluiceways across bars. These channels were about 50 feet wide and 2 feet deep at extreme low water and were improved by cutting out rock where necessary and piling up stones along the sides of chutes to direct water through them.

2. Use of stream.—The stream has been used to a limited extent for transportation of persons and property. This has been limited to the floating of logs and operation of row boats and ferries. The only use made at present of the river for navigation is limited to ferries.

3. Interruption to navigable parts of stream.—The proposed project does not involve falls, shallows or rapids compelling land carriage.

4. Jurisdiction of Congress.—The New River while not navigable in fact is legally a navigable stream, the Government in
3215 the past having expended moneys on this stream for channel improvement. The following proposed developments of water power on New River have been projected since the enactment of the Federal Water Power Law and have been considered as coming within the jurisdiction of the Federal Power Commission:

Project No. 223—W. Va. Preliminary permit granted to Charles B. Hawley, Washington, D. C., for power development at Sandstone Falls. This permit expired November 5, 1924.

Project No. 379—W. Va. and Va. Preliminary permit granted to the West Virginia Power Company, Charleston, W. Va., for power development at the mouth of the Bluestone River. This permit is still in force.

Project No. 542—N. C. Application submitted and pending for preliminary permit for power development on the New and Reddies Rivers in North Carolina.

Project No. 575—Va. and N. C. Application submitted and pending by the Eastern States Development Company, Wheeling, W. Va., for power development on the New River in Virginia and the Fisher River in North Carolina.

5. Effect on commerce.—(a) The proposed water-power development would be a benefit to navigation due to its probable regulation of low-water flow, provided the natural minimum low-water flow be not decreased.

(b) A permit or license for the proposed project should include a provision that the minimum flow immediately below the proposed dam be not less than the average minimum natural low-water flow, which is necessary for the maintenance of the pools above the dams in the Kanawha River, which stream is formed by the junction of the New and the Gauley Rivers.

(c) No action by any other agency of the United States will be necessary or desirable to fully protect the interests of commerce.

6. It is the opinion of this office that the New River is a navigable stream as defined by the Federal Power Act and that the proposed water-power project of the New River Development Company should be considered as coming under the jurisdiction of the Federal Power Commission.

(Signed) A. K. B. LYMAN,
*Major, Corps of Engineers, District Engineer.*

3216 (Views of Division Engineer, Central Division, on Report of the District Engineer, Huntington, W. Va. dated July 23, 1925, on Declaration of intention dated June 25, 1925 by the New River Development Co. for proposed water-power development in the New River near Radford, Va.)

1st Ind.

CWK/a.

Office Div. Engr., Cent. Div., July 25, 1925.

To the CHIEF OF ENGINEERS:

1. The Division Engineer concurs in the opinion of the District Engineer that the reach of New River under consideration comes under the jurisdiction of the Federal Waterpower Commission.

This opinoin is based primarily upon the fact that this reach of river was recommended to Congress for improvement after investigation under its authority, though not actually improved.

(Signed) C. W. KUTZ,
*Col., Corps of Engineers, Division Engineer.*

3217 *Government exhibit No. 94*

1925, October 15—Letter and memorandum of Major Trippe, District Engineer to Lt. Col. Edgerton, on probable effects of proposed Radford project on Kanawha River.

3218 WAR DEPARTMENT,
UNITED STATES ENGINEER OFFICE,
13th Floor Coal Exch. Bldg.
*Huntington, W. Va., October 15, 1925.*

Address Reply to U. S. Engineer Office, Huntington, W. Va.
Refer to File No. M668/8.

Subject: Effect of proposed power dam near Radford, Va. on navigation

Major G. E. EDGERTON, *Chief Engineer,*
FEDERAL POWER COMMISSION, *Washington, D. C.*

DEAR MAJOR EDGERTON: We have prepared the data you requested during your visit here October 10. The inclosed paper is a statement of the effect of the proposed dam of the New River Development Co. on New River near Radford, Va., on the navigation of the Kanawha River. We are also inclosing the memorandum you left here.

Very truly yours,

H. M. TRIPPE,
H. M. Trippe,
*Major, Corps of Engineers, District Engineer.*

2 inclosures—Statement; Memorandum.

3219 EFFECT ON NAVIGATION OF PROPOSED NEW RIVER DEVELOPMENT CO. PROJECT ON NEW RIVER NEAR RADFORD, VA.

In order to prevent interruption to navigation on the Kanawha River there must be enough discharge in the river to maintain the pools at their normal elevation. This means that the discharge must be equal to or greater than the leakage plus the lockage requirements or the pools will be drawn down and navigation interrupted because of insufficient depth. The movable dams have

a greater leakage than the fixed dams; hence their pools are the hardest to maintain.

During periods of occasional low water great difficulty is encountered in maintaining these pools. It is necessary to calk the wickets with timbers, brush, cinders, weeds, straw, manure, etc., to seal the spaces between the wickets. The past low water season, July, August and September, 1925, was the driest of record and in spite of the utmost care exercised it was impossible to maintain the pools of the movable dams up to normal. The natural flow of the river was not sufficient to provide for the leakage and the water required for lockages at any of the dams, fixed or movable. If the river discharge is decreased below the amount which occurred during the past season navigation would be proportionately restricted.

A table of the discharge records of the 1925 low water period and the 1914 low water period follows. The 1914 low water period was a period of occasional low water and the only such period for which complete records of flow for these points are available. The frequency of occasional low water is about once in five years.

| | Miles below proposed dam | Drainage area sq. mi. | 1914 low water—mean discharge in sec. ft. | | | | | 1925 low water—mean discharge in sec. ft. | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | July | Aug. | Sept. | Aver. | % | July | Aug. | Sept. | Aver. |
| 1. Lock No. 2 | 157 | 8,470 | 2,610 | 2,290 | 2,070 | 2,323 | 100 | 2,096 | 1,353 | 1,230 | 1,560 |
| 2. Radford | 7 | 2,720 | 1,650 | 1,480 | 1,330 | 1,507 | 64 | | | | |
| 3. Inflow between Radford and proposed dam | | 320 | 287 | 318 | 207 | 271 | 12 | | | | |
| 4. Site of proposed dam | 0 | 2,400 | 1,363 | 1,162 | 1,128 | 1,216 | 52 | | | | |
| 5. Lock #2 minus discharge at site of proposed dam (1–4) | | | 1,247 | 1,128 | 947 | 1,107 | 48 | | | | |
| 6. Percentage disch. at proposed dam to disch. at Lock #2 | | | 52 | 51 | 54 | 52 | | | | | |

3220 NOTE.—No. 3 figured by multiplying the ratio of drainage areas of Copper Valley gaging station on Little River to total difference in drainage area between Radford and the site of proposed dam by the discharge at Copper Valley. Thus, $\left(\frac{320}{195}\right) \times 175$ sec. ft. = 287 sec. ft., or the mean discharge for July, 1914.

The proposed reservoir with a dam 115 feet high is 4,000 acres in area and will doubtless store more than 100,000 acre feet of water. In a period of occasional low water such as that of 1914 the full flow of the river for 40 days will be required to fill the reservoir for the first time. Such a condition would seriously interefere with navigation.

The proposed installation is 80,000 horse power. Full operation at 85% efficiency and a head of 100 feet requires a discharge of 8300 second feet. The Federal Power Commission uses 70% ef-

ficiency in figuring the power capacity of a project, while the actual efficiency obtained is much greater. If the plant were operated as a daily peak load carrier in low water seasons it would release 8300 second feet for nine hours a day and nothing during the remainder of the day. A discharge of 6,000 second feet at Dam No. 5 produces one foot of depth on the crest of Dam No. 6. At this discharge it is generally necessary to lower the dam. The releasing of such a wave could cause the lowering and raising of the Kanawha River movable dams every day. This is utterly impractical.

Operation as a daily peak load carrier in a season of occasional low water such as 1914 would exhaust the 40,000 acre feet of storage in 11 days and require the full 24-hour flow for 16 days to fill again. This would seriously interefere with navigation.

The proposed dam above Radford may be operated so as to be beneficial to navigation by increasing somewhat the dry season flow by drawing upon the storage, but in the absence of authorized control the operation may be so conducted as to be a menace to navigation by causing alternate waves of excess and deficient discharge during the dry period. It is therefore concluded that the Federal Power Commission must retain jurisdiction over the proposed project in order to assure uninterrupted navigation.

U. S. ENGINEER OFFICE,
Huntington, W. Va.,
*October 15, 1925.*

3221 *Government exhibit No. 95*

1926, April 7—Letter from Merrill, Executive Secretary, to General Taylor, C. of E., transmitting data with respect to Pitt River. Attached is memo initialed "R. W. D." and diagram of variations on Pitt and Sacramento Rivers. (Original Exhibit.)

3222 *Government exhibit No. 96*

1926, July 23—Report of Hubert Deakyne, C. of E., to Merrill Executive Secretary on declaration for project No. 739.

3223

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
*Washington, July, 23, 1926.*

Address Reply to Chief of Engineers, U. S. Army, Washington, D. C.
Refer to File No. 7495 (New River Developt. Co.) 25.

The EXECUTIVE SECRETARY,
*Federal Power Commission, Washington, D. C.*

DEAR SIR: 1. Reference is made to your letter dated April 7, 1926, and the accompanying data with respect to the Pit and Sacramento Rivers in California and the application of these data to the variation of flow in the New River.

2. After having made a careful study of the data submitted I am of the opinion that due to the peculiar conditions existing in the Pit River as shown by the fact that there is practically no decrease in the height of the wave between its source at Pit #3 and Ydalpom, a distance of about 40 miles, the data do not give a true picture of how a wave travels down a river. Further, due to the totally different character of the two rivers, considerable doubt is felt as to the possibility of computing wave attenuation in the New River from data obtained in the Pit and Sacramento Rivers even if sufficient data on the latter streams were available. In my judgment the only correct procedure will be to study the action of the waves produced by the intermittent operation of the present plant at Ivannoe on the New River. Such a study has been started and will be continued until a satisfactory answer is obtained.

3. The previous report of this office dated December 29, 1925, on the effect of the proposed project would have on the navigation in the Kanawha River was based on records of stream flow from 1909 to 1916 inclusive. These records showed that during the period in question the drainage area below the proposed plant would provide sufficient water to meet the needs of navigation in the Kanawha River. The summer of 1925 was exceptionally dry and considerable difficulty was experienced in maintaining navigation in the Kanawha River. It appears, therefore, that at long intervals there may be seasons in which the stream flow is smaller than that covered by the years 1909–1916 and during which the run off from the area below Radford might be inadequate for navigational purposes.

4. I, therefore, report that there is reason to believe that in the future exceptionally dry seasons may occasionally occur dur-

ing which the proposed project near Radford, if unregulated, might adversely affect the navigable capacity of the Kanawha River.

Very respectfully,

HERBERT DEAKYNE,
*Brig. Gen., C. of E.,*
*Acting Chief of Engineers.*

3224 *Government exhibit No. 97*

1925, Dec. 29—Report of General Taylor, C. of E. to Executive Secretary on declaration for project No. 739.

3225 WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
*Washington, December 29, 1925.*

Refer to File No. 7495. (New River Developt. Co.) 18.

The EXECUTIVE SECRETARY,
*Federal Power Commission, Washington, D. C.*

DEAR SIR: 1. Under date of October 28, 1925, you transmitted to this office a memorandum from the New River Development Company by their attorneys, Messrs. Curtis, Mallet-Prevost, Colt & Mosle, in which request is made that the Chief of Engineers reconsider his report of August 20, 1925, to the Federal Power Commission on the Declaration of Intention of the New River Development Company.

2. In that report the Chief of Engineers stated that "while the navigable capacity of the stream is limited this office must report that no sufficient reason is seen why the Federal Power Commission should not exercise jurisdiction over the proposed project."

3. The declarant now requests reconsideration of those portions of this report relating to:

A. The navigability of New River.

B. The effect of the proposed project upon the navigable capacity of the Kanawha River.

A careful study has been made of all the data presented by the declarant and a further study has been made of all available data and records bearing on the questions at issue which are available in this office, or which could be obtained from other government bureaus. The following report is the result of the additional studies which have been made and the additional information which has been obtained since the date of my previous report:

A. As to the navigability of New River.

What constitutes a navigable water of the United States within the meaning of the commerce clause of the Constitu-
3226 tion and the acts of Congress based thereon, including the Federal Power Act, has been defined in numerous decisions of the Supreme Court and from these decisions the following rule is deduced:

A stream is navigable in law when it is navigable in fact, and it is navigable in fact when, in its natural or improved condition, it affords a channel for useful commerce of a substantial and permanent character, conducted in the customary modes of trade and travel on water. A theoretical or potential navigability, or one that is temporary, precarious and unprofitable, is not sufficient, but to be navigable in fact a watercourse must have practical usefulness to the public as a highway for transportation. A stream navigable in fact, as thus defined, is a navigable water of the United States when it forms by itself, or by uniting with other waters, a continuous highway over which commerce may be conducted between the States.

Having this rule in mind, I am of the opinion that the data and information disclosed in the Department's records and reports do not support the conclusion that New River affords a channel for useful commerce or that it is navigable in fact. That section of the river between its mouth and the town of Hinton, having a fall of about 735 feet in a distance of less than 60 miles, may be dismissed from discussion. This Department has reported that the whole section is unfavorable for navigation and that it could not be connected with navigation in the Kanawha by the expenditure of any reasonable amount.

Surveys have been made in accordance with the direction of Congress of the stretch of river extending from Hinton, W. Va., at the mouth of Greenbrier River, upstream to the mouth of Wilson Creek in Virginia, a distance of about 190 miles. The lower 24 miles only of this stretch is in West Virginia, the remainder being in the State of Virginia and embracing practically all of the stream in that State. Survey of 128 miles, from Greenbrier River to the "Lead Mines," was made in 1872, and of the 62 miles from "Lead Mines" to Wilson Creek, in 1878, the results being printed in the annual reports of the Chief of Engineers,
3227 for 1873, pages 842 et seq., and 1879, pages 538 et seq. These surveys are very detailed, covering the river mile by mile throughout the 190-mile stretch, and the reports thereon afford the only reliable information on record of original conditions. From the survey report of 1872 on the 128-mile section below "Lead Mines," the following is quoted:

"The river in its present condition presents the usual features of mountain streams, reaches of comparatively still and deep water separated by rapids and shoals. In the upper portion for 35 or 40 miles the pools are generally very short, whole miles being composed of ledges of slate or limestone, 200 or 300 feet apart, with small pools between. In the lower portion, though the rapids are more concentrated, yet even then the pools will hardly average more than one mile in length. The total fall from Lead Mines to Greenbrier is 531 feet, or about 4¼ feet per mile."

The survey report of 1879, on the 62-mile section above Lead Mines, contains the following:

"As is usual with mountain streams, this river presents pools of comparatively deep and still water, separated by rapids, shoals and falls. The water flows in the pools at about the rate of 1 mile per hour; over the rapids at the rate of 3 miles per hour, and over the falls at about the rate of 5 miles per hour. The depth usually over the falls is from 9 to 12 inches; frequently however, obstructions are formed below by bowlders, which increased this depth to 2 feet. Throughout this survey the pools are very short, whole miles being composed of ledges of gray and blue granite or slate, a few hundred feet apart, with very short pools between. Only five pools of a mile in length in this portion of the river. The total fall in the river from the mouth of Wilson to the Lead Mines is 507 feet, or about 8½ per mile."

The detailed, mile by mile, data given in the reports fully justify these concrete statements, and it seems unquestion-
3228 able that the river was not navigable in fact in its original natural condition.

It is my opinion that these natural conditions were not changed by subsequent improvements, to the extent of making the river a highway for commerce.

It appears from the annual reports of the Chief of Engineers that the work of improvement accomplished up to the time it was finally discontinued is as follows:

1. From Hinton Landing to Wiley's Falls, a distance of 26 miles, a channel 50 feet wide and 2 feet deep was obtained, practically all of which is in West Virginia, less than 2 miles extending into Virginia. The fall in this distance is 104 feet. From Wiley's Shoals to New River Bridge, a distance of about 60 miles, a succession of falls, shoals and rapids, no improvement work was undertaken.

2. Above New River Bridge and between that point and the Lead Mines, 29½ miles of channel was deepened to 2 feet, 12 miles of which was widened to 30 feet, 2½ miles to 20 feet, and 15 miles to 10 feet. On account of the existence of Fosters Falls, the fall being 18 feet in less than half a mile, improvement work was carried no farther on this stretch.

3. Above Lead Mines, on a reach of 62 miles, about 5 miles of channel was improved to a depth of 2 feet and width of 20 feet.

Of the 190 miles of river embraced in the adopted projects, work was carried on only on about 60 miles, and this 60 miles was divided into 3 widely separated stretches with long unnavigable reaches between them. Work was limited to the most easily improved places and effort made to so ameliorate conditions as to permit local navigation. The results were not satisfactory or important and Congress discontinued appropriations after 1886, less than one-third of the funds required for any effective improvement having been provided. In 1899, the Chief of Engineers dropped the work from his annual report, and in the river and harbor act of 1902, Congress repealed all previous
3229 provisions of law providing for the prosecution of work on the river and directed the return to the Treasury of the unexpended balance of funds pertaining thereto. The river was not thereafter considered an authorized project for improvement.

It is evident that the work executed by the Government during the years 1877–1882, did not materially change the natural nonnavigable conditions of the river. The improvement effected was at most slight and fragmentary, and the small channels worked over are reported to have deteriorated due to the natural action of ice and the current. Continuous navigation on the river has never been possible, and whatever commerce has existed has been altogether local apparently confined to the 25-mile section in West Virginia ending at Hinton.

The District and Division Engineers have reported that there is no commerce and that the river is not now navigable in fact, but they assume that it is legally navigable for the reason that money has been expended on it for channel improvement by authority of Congress. It is well settled by judicial decisions that acts of Congress appropriating money for the improvement of a stream are not to be construed as declarations express or implied that the stream is actually navigable. Congress may authorize the improvement of a nonnavigable stream with a view to creating navigability, yet unless the improvement is accomplished the natural state of the stream is not changed. Whether or not it is

navigable is still a question of fact unaffected by the consideration that money has been appropriated and expended in an effort to improve it.

I, therefore, conclude that New River is not at the present time a navigable water of the United States within the meaning of the Constitution and laws of Congress, including section 3 of the Federal Power Act.

B. As to the effect of the proposed project upon the navigable capacity of the Kanawha River.

The site of the proposed dam is 155 miles above the head of navigation on the Kanawha River. The New River between this site and the Kanawha River is a series of pools of comparatively still and deep water separated by rapids and shoals.

3230

There is no known method of computing with any degree of accuracy the effect of fluctuations in flow at the dam on the stage of the river at various distances below the dam. The pools would act as a series of storage reservoirs, the effect of which would be to equalize the flow. I am of the opinion that any periodic fluctuations in flow due to normal operation of the project works would be so attenuated by the time they had reached the Kanawha 155 miles distant as to preclude the probability of any adverse effect upon navigation on that river.

It may be assumed as a possibility that the plant might be closed down completely for an indefinite period of time during a dry season and at a time when the storage above the dam had been drawn down. In the event of such a combination of circumstances all water from the drainage area above the dam would be shut off until the reservoir filled or until operations were resumed.

The drainage area above Dam No. 2, the upper dam in the Kanawha River, is 8,470 square miles. The drainage area above the site of the proposed dam is 2,396 square miles. The drainage area between the proposed dam and Dam No. 2 is therefore 6,074 square miles. Records of the measured flow for the years 1909–1916 are available for streams which drain a total of 3,714 square miles of this intermediate area. From these records the total flow of the drainage area below the proposed dam has been computed for each month of the years for which records are available. It is found from these computations that the run-off from this drainage area below the proposed dam is sufficient to supply the necessary water for navigation on the Kanawha River under the existing project.

Therefore, so far as can be predicted from available data and records it would not be possible to operate the proposed project so as to adversely affect navigation on the Kanawha River under the existing project.

I, therefore, report that in my opinion New River in its present condition is not a navigable stream and that navigation on
3231 the Kanawha River will not be adversely affected by the proposed power development.

Very respectfully,

H. TAYLOR,
*Major General, Chief of Engineers.*

3232 *Government exhibit No. 98*

1927, Apr. 12—Report of General Deakyne, C. of E.; 1926 Dec. 22—Report of Major Trippe, Dist. Eng.; 1927, Jan. 13—1st. Endorsement Col. Kutz, Division Engr. In dealing with application for license for project #739.

3233 WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
*Washington, April 12, 1927*

Address Reply to Chief of Enginners, U. S. Army, Washington, D. C.

Refer to File No. 7495 (Appalachian Elec. Pow. Co.)-3.

The EXECUTIVE SECRETARY,
*Federal Power Commission, Washington, D. C.*

DEAR SIR: 1. The letter of the Acting Chief Engineer in the absence of the Executive Secretary, dated September 9, 1926, referred to this office for investigation and report the application of the Appalachian Electric Power Company, (Proj. #739, Va.) for a license for a power development on the New River near Radford, Va.

2. The investigation has been made by the District Engineer at Huntington, W. Va., and his report dated December 22, 1926, is herewith.

3. The New River is formed by the junction of the north and south Forks near the town of Weaversford in Ashe Co., N. C. It flows first generally northeasterly to near Radford, Va., then makes about a 90 degree turn and flows generally northwesterly to just above Kanawha Falls where it joins the Gauley River forming the Kanawha River. The Kanawha River has been improved for slack water navigation by the Federal Government from its mouth to 7 miles below Kanawha Falls, a distance of about 89 miles. The navigation improvements on the New River have been covered in the various reports from this office on the declaration of intention of the New River Development Company.

4. The applicant proposes to build one dam about 6 miles above Radford, Va., and 155 miles above the head of navigation in the Kanawha River. The dam will create a navigable pool about 19

miles long extending from the dam up to about 2 miles above Clarks Ferry.

5. The principal data regarding the project are as follow:

Location, Near Radford, Va.

| | | |
|---|---|---|
| Project Area | acres | 5,809 |
| Height of dam | feet | 110 |
| Draw down | feet | 10 |
| Useful storage | acre feet | 40,000 |
| Open river flow: | | |
| Minimum | second feet | 560 |
| Average | second feet | 3,770 |
| Maximum | second feet | 138,000 |
| Regulated flow—90% of time | second feet | 1,260 |
| Average static head | feet | 106 |
| Power capacity | horsepower | 10,176 |
| Probable installed capacity | horsepower | 80,000 |

3233-A 6. For the effect of the project on the navigable portion of the Kanawha River see the report from this office, on the declaration of intention of the New River Development Company, 7495 (New River Development Co.)—25, dated July 23, 1926.

7. A public hearing was held at Radford, Va., on October 28, 1926, at which demands were made that the flow of the river be regulated in the interest of navigation and power production as follows:

The Great Kanawha River Improvement Association—to protect navigation in the Kanawha River.

The Virginia Railway Co.—to provide condensing water for the steam plant at the Narrows.

The Electro Metallurgical Co.—to provide ample water for the hydro-electric plant at Kanawha Falls.

The Public Service Commission of West Virginia, in the interests of navigation and power in general.

It is believed that the conditions recommended to be inserted in the license, if issued, will protect all the above protestants and furnish sufficient water to provide for the requirements of navigation in the Kanawha River and for power production on the lower reaches of the New River.

8. The design of the dam has been checked and has been found to be satisfactory so far as the requirements of navigation are concerned. Attention is called to the recommendations of the District Engineer (Par. 18) that the intake of one of the penstocks be lowered so that advantage may be taken of the storage below the proposed 10-foot draw down during periods of low flow. It is believed this point should be given further study.

9. The applicant and subsidiary companies at present operate thirteen plants with an installed capacity of about 298,000 K. W. and an extensive transmission system. The present project will

be operated as a peak load plant and no trouble should be found in utilizing the additional power under these conditions.

3234 10. The applicant is controlled by the American Gas and Electric Company which is believed to possess ample funds to finance the present project.

11. It is recommended that the licensee be required to begin construction within one year and to complete the construction of the project within 4 years from the date of the license.

12. I concur in the recommendation of the District Engineer that a license be granted the applicant provided it is subject to the following conditions, articles 3, 4, 5, 7, 8, 9, 10, 11, 12, 15, 16, 19, 22, 23, 24, 25, 26, 27, 28, 29, 30 of license No. 432 and to the following condition:

The licensee shall at all times discharge a minimum of 8,050 acre-feet per week over or through the dam. Whenever the flow at Lock No. 2, Kanawha River, falls below 1,400 second feet the licensee, when so directed by the Secretary of War, shall discharge in each 24 hours the minimum flow of the river during that period up to a discharge of 1,150 acre-feet. The above discharge shall at all times be regulated by such rules and regulations as the Secretary of War may prescribe to prevent interference with navigation on the Kanawha River.

HERBERT DEAKYNE,
*Brigadier General,*
*Acting Chief of Engineers.*

12 inclos., viz:
Sub. 1—Application.
Serial 10—Report.
Subs. 1 & 2 of Ser. 10—Notice of public hearing.
Sub. 3 of Ser. 10—Public hearing.
Subs. 4 to 9 of Serial 10—Correspondence.
Sub. 10 of Ser. 10—Statement by applicant.

3235

WAR DEPARTMENT,
UNITED STATES ENGINEER OFFICE,
13TH FLOOR, COAL EXCHANGE BUILDING,
*Huntington, West Virginia, December 22, 1926.*

Address Reply to U. S. Engineer Office, Huntington, W. Va.
Refer to file no. M669/2.

Subject: Report on Application for License for Proposed Power Development in the New River in Pulaski County, Virginia, by the Appalachian Electric Power Co., Project No. 739, Virginia

To: The Chief of Engineers, U. S. Army, Washington, D. C.
(Through the Division Engineer, Central Division, Cincinnati, Ohio).

1. Complying with the request of the Federal Power Commission dated September 9, 1926, there is submitted herewith a report

on the application for license filed by the Appalachian Electr
Power Co. of Richmond, Virginia, for a power development in t
New River in Pulaski County, Virginia (Federal Power Proje
No. 739 Virginia).

RESUMÉ

Project Number: 739 Virginia.
Applicant: Appalachian Electric Power Co. of Virginia.
Stream: New River, tributary to Kanawha River.
Project Works: Dam: Concrete 110 feet high across New Riv
Reservoir: 19 miles long with surface of approximately 4000 acr
Conduits: 4 steel penstocks imbedded in dam. Powerhouse: Bri
and steel containing 4, 15,000 k. w. alternating current generato
Transmission lines: Power to be generated at 13,200 volts, 60 cyc
and conducted into transmission system 500 feet outside of t
project.
Project area: 5,800 acres.
Public lands: None involved.
Storage capacity: 40,000 acre-feet with a 10-foot drawdown.
Stream flow: Minimum 560 second-feet. Average 3,770 secon
feet. Maximum 138,000 second-feet. Regulated minimum 9
second-feet.
Average static head: 106 feet.
3236 Power capacity: 10,176 h. p.
Proposed Installed Capacity: 60,000 k. w. or 80,000 h.
Modification recommended: None.
Special condition: Licensee shall: Furnish detail plans; mai
tain stream gaging station; clear reservoir; pass continuously t
minimum natural flow; be governed by rules of the Secretary
War and the Federal Power Commission.
Important recommendations: License be granted.

## 2. Watershed

The sources of New River lie in the Appalachian Mountai
among the high ridges that form the divide between the Peed
and Santee Rivers, which drain eastward into the Atlantic Ocea
and the streams which drain westward through the Tennesse
Ohio and Mississippi Rivers into the Gulf of Mexico. It may
said that the river rises in the central part of Watauga County,
the extreme northwest corner of North Carolina, at an elevatio
of about 3700 feet. Thence it flows northeasterly into Virginia
a point a short distance below Radford where it makes almost
90-degree turn and flows northwesterly through a gap in the All
gheny Mountains into West Virginia. It joins the Gauley Riv
a short distance above Kanawha Falls, forming the Kanawh

River. The Kanawha in turn flows northwesterly into the Ohio River at Point Pleasant, West Virginia.

The complete system of the New-Kanawha is 429 miles long and drains 800 square miles in North Carolina, 3,000 square miles in Virginia and 8,400 square miles in West Virginia.

The New River flows down a steep gradient from its source to the vicinity of Ivanhoe, Va. (mile 147 from source). From Ivanhoe to a point about 10 miles below Hinton, W. Va. (point at mile 280), the gradient is flatter. Through this reach the river bed is a series of pools connected by short rapids.

At a point about 10 miles below Hinton the river enters a gorge, the channel being narrow and the gradient steep for about 50 miles. The river abruptly leaves the gorge and merges with the Gauley River to form the Kanawha River a short distance above Kanawha Falls (mile 334). The falls here are about 27 feet high. From Kanawha Falls the gradient averages about 3 feet per mile for 7 miles and then is very flat to the mouth.

The Kanawha is improved for slack water navigation from a point 7 miles below Kanawha Falls to its mouth at Point Pleasant, a distance of 89 miles. This improvement is maintained by two fixed dams (furthest upstream) and eight movable dams. The valley of the Kanawha abounds in a vast amount of natural wealth and the river affords a valuable transportation outlet for these resources.

3237 The elevation of New River at the proposed development is 1,725 feet. The watershed above this point is largely timbered, the river flowing through sparsely-settled, rugged mountain country. Being in the Appalachian region the basin is subject to storms from the Atlantic Ocean as well as from the Gulf of Mexico. Owing to this the valley is not immune to high water or floods in any month of the year.

The following table gives distances, elevations, and slopes for several points along the New-Kanawha River.

| | Elevation | Distance | Fall between points | Distance between points | Average fall per mile |
|---|---|---|---|---|---|
| | *Feet* | *Miles* | *Feet* | *Miles* | *Feet* |
| Sources | 3,700 | 0 | | | |
| Junction of North and South Forks | 2,500 | 86 | 1,200 | 86 | 14.0 |
| Oldtown, Va | 2,220 | 126 | 280 | 40 | 7.0 |
| Radford, Va | 1,720 | 192 | 500 | 66 | 7.6 |
| Va.-W. Va. State Line | 1,490 | 245 | 230 | 53 | 4.3 |
| Hinton, W. Va | 1,365 | 270 | 125 | 25 | 5.0 |
| Kanawha Falls (Head) | 650 | 334 | 715 | 64 | 11.2 |
| Kanawha Falls (Foot) | 623 | 334 | | 0 | |
| Head of Navigation | 595 | 340 | 28 | 6 | 4.7 |
| Mouth | 510 | 429 | 85 | 89 | 1.0 |

## Geology

The great topographic feature of the region is a peneplain of Tertiary age which stands at 2,000 to 2,100 feet elevation. After the upraise the New River and its immediate tributaries cut down some 300 feet through the peneplain. Where the formation was hard the gorge is 500 to 1,000 feet wide. In softer formation the gorge is rounded to a valley several thousand feet wide.

Structurally the region is characterized by folds and thrust faults. In the mountain section, where stiff sandstones are present, the structures are on a large scale. Structures are generally easily determinable since easily recognizable formations are also present. In the limestone valley structures are less easily recognizable. Here structural units vary from hundreds of miles down to miles or even rods, and satisfactory determination of the true relations of the various units is not a simple matter. The forces which produced these structures acted at various times, some of which were separated from others by long erosion periods which cut many thousands of feet into these strata. While it is known that certain movements took place at certain times with reference to other movements the sequence of events is not known in detail and even the periods of geologic time in which these took place are not certainly known.

The dominant structure of the region is a broad thrust fault. This great thrust took place late in a series of thrusts. The greater part of the folding and faulting of the region had taken place before this thrusting occurred. The underlaying material contains folds and faults which are certainly older than the thrust fault.

8238 Some of the folds and faults of the overthrust, and probably most of them, antedate the overthrust but their date is not so easily established. It seems quite certain that there was some folding after the overthrust.

The rocks of the region are well consolidated sediments. The Sandstones are all well cemented but only occasionally quartzitic. The shales are platy but never slates. The dolomites and limestones are generally compact to finely crystalline. There, acutely folded, the dolomite is sometimes much recrystallized. Where mild shattering has taken place there is recementation with the vein material either calcite or dolomite, or there may have been two periods of vein formation with one set of veins, usually the older, of dolomite and another set of calcite.

## 3. References

The following public documents and reports contain information concerning the water resources of the New River:

Survey from the mouth of the Greenbrier River to Kanawha Falls in the Kanawha River, made in 1819 by Moore and Briggs under the auspices of the Board of Public Works of the State of Virginia. (Erroneously mentioned in previous reports as between Sinking Creek and Greenbrier River.) The survey was made with the view of connecting the waters of the James and Kanawha Rivers by a canal.

"Examination and Survey of New River from the mouth of Greenbrier, West Virginia, to the lead mines in Wythe County, Virginia." (Senate Ex. Doc. No. 25, 2d Congress, 3d Session, Annual Report, Chief of Engineers, 1873, pages 78 and 842.) This report treats of navigation features only.

"Examination of New River, from the lead mines, in Wythe County, to the "Mouth of Wilson," in Grayson County, Virginia." (Annual Report, Chief of Engineers, 1875, part 2, page 133). This report treats of navigation features only.

"Survey of New River, Virginia, from the lead mines, in Wythe County, to the mouth of Wilson Creek in Grayson County." (Senate Ex. Doc. No. 41, 45th Congress, 3d Session, Annual Report, Chief of Engineers, 1879, part 1, page 538.) This report treats of navigation features only.

"Examination of New River at its confluence with the Greenbrier River, West Virginia." (House Doc. No. 176, 58th Congress, 2d Session, Annual Report, Chief of Engineers, 1904, part 3, page 2617.) This report treats of navigation features only.

Report by Captain F. W. Altstaetter, Corps of Engineers, to the Chief of Engineers, Nov. 21, 1908, with remarks on circular No. 143, Forest Service, U. S. Dept. of Agriculture entitled "The Relation of the Southern Appalachian Mountains to Inland Water Navigation." (E. D. 62315/21.) This circular and report defend opposing views of the possibilities of improving navigation on the Kanawha River by a system of storage reservoirs.

"Examination of New River from Radford, Va., to Hinton, W. Va." (House Doc. No. 1410, 62d Congress, 3d Session.) This report treats of navigation features only.)

Report on Water power dams, New River, Nov. 23, 1912, and 4th indorsement thereon, July 15, 1913, by the District
3239 Engineer, Wheeling, W. Va., to the Chief of Engineers (E. D. 67022/13). These reports describe the water-power developments of the Appalachian Power Co. constructed without authority from Congress and proposed to be constructed in the New River.

"Dams or Reservoirs, Cheat and New Rivers, Va. and W. Va." (Senate Doc. No. 15, 63d Congress, 1st Session.) This document contains papers, correspondence, permits, etc., pertaining to the

construction of dams or reservoirs by private parties in New River.

Preliminary examination of Cheat, Tygarts, West Fork, and Kanawha Rivers, Pa. and W. Va. (House Doc. No. 1792, 64th Congress, 2d Session, page 17.) This report describes possible means of flood prevention in the New-Kanawha valley.

Report of Nitrate Plant Investigation, Feb. 15, 1917, and 2d indorsement thereon Feb. 17, 1917, by the District Engineer, Wheeling, W. Va., to the Chief of Engineers. (E. D. 99516 and E. D. 99516/537.) Also contains briefs submitted by A. D. Preston and the Virginian Power Co. These reports describe the possible waterpower developments in New River with relation to the construction of nitrate plants.

Report on application of Chas. B. Hawley for preliminary permit for proposed power development on the New River at Sandstone Falls near Hinton, W. Va., 2d indorsement, Sept. 14, 1921, by the District Engineer, Wheeling, W. Va., to the Chief of Engineers. (E. D. 131895.)

Report on application of the Virginian Power Co. for preliminary permit for proposed power development on New River, Bluestone River, and Indian Creek, near Hinton, W. Va., Proj. No. 379, 2d indorsement, June 13, 1923, by the District Engineer, Huntington, W. Va., to the Chief of Engineers. (E. D. 136057.)

Report on application of the Central Power Co. for preliminary permit for proposed diversion of New River waters and development of power on the New and Reddies Rivers in North Carolina, Proj. No. 542, 2d indorsement, June 13, 1925, by the District Engineer, Huntington, W. Va., to the Chief of Engineers. (E. D. 7495, Cen. Power Co.)

Report on application of the Eastern States Development Co. for preliminary permit for proposed diversion of New River waters and development of power on the New River in Va., and the Fisher River in N. C., Proj. No. 575, 2d indorsement, June 13, 1925, by the District Engineer, Huntington, W. Va., to the Chief of Engineers. (E. D. 7495, Est. Stat. Dev. Co.)

Report on declaration of intention of the New River Development Co. for proposed power development in the New River near Radford, Va., 2d indorsement, July 23, 1925, by the District Engineer, Huntington, W. Va., to the Chief of Engineers. (E. D. 7495, New Riv. Dev. Co.) This project is the subject of this report on application for license.

Statement of the "Effect on navigation of proposed New River Development Co. project on New River near Radford, Va.," made by the District Engineer, Huntington, W. Va., to the Chief Engineer, Federal Power Commission, Oct. 15, 1925. This project is the subject of this report on application for license.

"Report on the waves caused in the New River by the intermittent operation of the Appalachian Electric Power Co.'s hydropower plant near Ivanhoe, Va.," by the District Engineer, Huntington, W. Va., to the Chief of Engineers under 1st indorsement, June 9, 1926. (E. D. 7495, New Riv. Dev. Co. 33.)

3240 U. S. Geological Survey Water Supply Papers as follows:

No. 536, contains summary with all discharge records in the New-Kanawha drainage basin, 1898 to 1918.

No. 503, Part III, contains discharge data on New River for 1919 and 1920.

No. 523, Part III, contains discharge data on New River for 1921.

No. 543, Part III, contains discharge data on New River for 1922.

### 4. Development in New River

The Federal Government has done work in New River for the improvement of navigation. This consisted of building channel chutes or sluiceways across the bars. These chutes were about 50 feet wide and 2 feet deep at extreme low water and were improved by cutting out rock, where necessary, and piling up stones along the sides of the chutes in order to direct the water through them. This work extended from Hinton upstream a distance of about 25 miles. About $100,000 was expended on the work previous to 1883, and $10,000 since that time. These chutes have deteriorated from the natural action of the current and ice.

Work done by private parties in the development of the watershed has been the construction of the following water-power plants:

| Location | Owner | Date operation commenced | Head (feet) | Type of dam | Horsepower | |
|---|---|---|---|---|---|---|
| | | | | | Max. | Aver. |
| Fries, Va | Washington Mills | 1901 | 40 | Fixed | 2,800 | 1,300 |
| Byllesby, Va | Appalachian Power Co. No. 2 Dev. | 1912 | 52 | Fixed with movable crest. | 24,000 | [1] 4,840 |
| Buck, Va | Do. No. 4 Dev. | 1912 | 41 | Do | 12,000 | [1] 3,380 |
| Kanawha Falls, W. Va. | Electro Metallurgical Co. | 1899 | 28 | Fixed | 6,000 | 5,000 |

[1] For years 1922 to 1924.

At Fries, Va., the operation of the plant is on a ten-hour basis, but by means of hourly storage the entire low-water discharge is used.

The plants of the Appalachian Power Co. are installed for a capacity of 4,800 second-feet, which is maintained about 5.5 per-cent of the time. They have hourly storage and are used as daily peak load carriers during most of the time.

The Kanawha Falls plant is used in a metallurgical process which requires a continuous 24-hour load. A permit was issued February 27, 1899, by the Secretary of War for the dam on the crest of the falls.

3241 The plant at Fries was authorized by Act of Congress approved June 4, 1900 (34 Stats., L, 264). However, the dam is probably an illegal structure since the plans were not presented to or approved by the War Department in accordance with Sect. 8 of the Act of March 3, 1899. (See par. 3, page 30, Sen. Doc. No. 15, 63d Congress, 1st Session.)

### 5. Rainfall and run-off data

The average annual precipitation in the basin above the proposed project is between 40 and 50 inches with an average run-off of 20 inches.

The U. S. Geological Survey have maintained a number of stream gaging stations in the basin of the New-Kanawha River. From the following pertinent stations the discharge and run-off have been computed for the proposed project:

| Station | Drainage area (sq. mi.) | Maintained |
|---|---|---|
| Copper Valley on Little River, 13 miles above mouth. | 195 | Aug. 1908 to Sept. 1915. |
| Radford on New River, 6 miles below project | 2720 | Aug. 1898 to Jul. 1906.<br>May 1907 to Sept. 1915. |
| Eggleston on New River, 30 miles below project | 2920 | Oct. 1914 to date. |
| Kanawha Falls on Kanawha River, 149 miles below project. | 8300 | Apr. 1877 to date. |

The drainage area at the proposed dam site is 2,400 square miles. Of the 320 square miles of drainage area between the dam site and the Radford gage, 195 square miles of this are above the Copper Valley gage on Little River. On the assumption that the run-off per square mile for the whole of the 320 square mile area was the same as the run-off per square mile for the area above Copper Valley, the run-off at the dam site was computed by subtracting from the Radford run-off the inflow between the dam site and Radford. With this, and the assumption that between August 1906 and April 1907 the relation between the Radford and

Kanawha Falls run-off was the same as the average relation for the periods five years before and five years after, the run-off was computed for the water years 1899 to 1915. On the assumption that the run-off per square mile above Radford was the same as that above Eggleston and the above relation between the 3242 dam site and Radford, the run-off was computed for the water years 1916 to 1926. Thus a complete record of monthly mean flow from 1898 to 1926 was determined.

Water Supply Paper No. 536 states on page 24 that the minimum flow at Radford is probably between 500 and 700 second-feet. The flood of September 15, 1878, reached a stage of about 37.4 on the U. S. G. S. gage. The highest stage recorded was 30.2 feet on May 22, 1901, discharge roughly 138,000 second-feet.

The applicant has submitted duration curves as Exhibit I–A. These have been computed on the assumption that the flow at their dam site was 84 percent of that at Eggleston, which is regarded as sufficiently accurate for the purposes of the studies. The average value used in the estimate of the monthly mean flow was 82.22 percent.

Using the duration curve the discharge available 90 percent of the time is 1,200 second-feet which is regarded as the available water supply.

6. Storage reservoirs

Several storage reservoir sites are available in the New River (a) to (i) of table in Section 7. The seven sites of the Central Power Co. were proposed in connection with their application for preliminary permit to divert water from the New River through the Appalachian divide into the Yadkin River drainage on the Atlantic slope. The Oldtown reservoir site was proposed by the Eastern States Development Co. in application for preliminary permit for a similar diversion project. The Federal Power Commission has refused these permits and it is not known if they intend to use them for regulation of flow in New River or that such is feasible.

It is not known whether the Appalachian Electric Power Co. intends to develop their proposed site or not.

The climatic conditions in the headwaters of New River are such that it is very difficult, if not impossible, to predict flow conditions with any reliable degree of accuracy. The following table and Exhibit A show this very forcefully. This table and diagram were made from the computed 28-year record of monthly mean flow mentioned in Section 5, page 9.

TABLE SHOWING IRREGULAR OCCURRENCE OF LOW AND HIGH WATER FLOW IN NEW RIVER

Each month was among the three lowest, two lowest, or was the lowest month during the year the number of times shown; likewise the highest the number of times shown.

| | Among 3 lowest months | Among 2 lowest months | Lowest month | Among 3 highest months | Among 2 highest months | Highest month |
|---|---|---|---|---|---|---|
| | *Times* | *Times* | *Times* | *Times* | *Times* | *Times* |
| Jan | 2 | 1 | 1 | 11 | 11 | 6 |
| Feb | | | | 14 | 10 | 6 |
| Mar | | | | 18 | 13 | 8 |
| Apr | | | | 13 | 7 | 2 |
| 3243 May | | 2 | | 9 | 6 | 1 |
| June | | | | 6 | 2 | 1 |
| July | 6 | 4 | 2 | 3 | 2 | 2 |
| Aug | 15 | 11 | 5 | 3 | 1 | 1 |
| Sept | 15 | 11 | 5 | | | |
| Oct | 14 | 9 | 8 | 2 | 1 | 0 |
| Nov | 19 | 14 | 5 | | | |
| Dec | 5 | 4 | 2 | 5 | 3 | 1 |

The above table shows that the prediction of low or high water is never greater than 68 percent and that in occasional years high water will come when low water is generally expected. Likewise, low water will come when high water is generally expected. The fact that the chances are about the same that December may be a low or high water month shows that the low water season may be of ' ng duration. The duration curves of monthly flow (Exhibit A) show that the prediction of the amount of flow is also uncertain. While the curves for August, September, October, and November are fairly close together and regular the curves for the other months, and particularly the months that would be used for filling a reservoir, are very irregular and cover a wide range in flow for a good percentage of time.

The reservoir sites in the upper part of the river are in reaches where steep gradients control. From this and the above facts it might be found that unreasonably large and expensive reservoirs might be necessary for a small or even fair amount of regulation.

The proposed reservoir of the project applied for has heretofore been regarded as a storage possibility. The applicant proposes using only 40,000 acre-feet of the total reservoir contents as storage water. This is a small amount and is likely to be most used in leveling or increasing the hourly and daily fluctuations during any month. Its principal use will probably be in increasing the monthly and seasonal flow in extremely low water periods. The use of storage from this site decreases the head very fast and consequently the amount of power from a given amount of flow decreases as the demand for power increases.

The Oldtown reservoir site of the Eastern States Development Co. will develop 329,900 acre-feet of storage and a uniform draft of 1775 second-feet.

No topographical surveys have been made of the other sites and definite quantities cannot be given.

## 7. Power sites

New River with its high run-off and steep gradient possesses a great wealth of water power. The development of this power is retarded on account of the proximity to the Appalachian coal fields and almost prohibited in some reaches because of railroads on the river bank. Due to these it is only under the most favorable conditions that a waterpower development is feasible.

3244 No complete survey has been made to determine all the favorable locations of power sites. Those sites known from available data are as follows:

*Table of Dam Sites on New River*

| Site | Distance from sources | Approx. head | Drainage area | Remarks |
|---|---|---|---|---|
| | *Mi.* | *Ft.* | *Sq. mi.* | |
| (a) Central Power Co. No. 8, Plan G-1, So. Fk., New Riv. | 66.5 | 120 | 300 | |
| (b) Cen. Pow. Co., No. 3, Plan G-2, So. Fk., New Riv. | 86 | 220 | 325 | |
| (c) Cen. Pr. Co., No. 6, Plan G-2, No. Fk., New Riv. | 86 | 220 | 279 | |
| (d) Cen. Pr. Co., No. 4, Plan G-1 | 97 | 160 | 620 | |
| (e) Cen. Pr. Co., No. 4, Plan G-2 | 107 | 170 | 808 | Lies in pool of (i). |
| (f) Cen. Pr. Co., No. 5, Plan G-1 | 111 | 100 | 825 | Do. |
| (g) Cen. Pr. Co., No. 5, Plan G-2 | 119 | 80 | 1,010 | Do. |
| (h) App. Pr. Co., Site "A" | 124.5 | 50 | 900 | Do. |
| (i) Oldtown Res | 129 | 180 | 1,140 | |
| (j) Washington Mills | 135.5 | 40 | 1,150 | Existing and in operation. |
| (k) App. Pr. Co. No. 1 | 140 | 60 | 1,200 | |
| (l) App. Pr. Co. No. 2 | 143 | 52 | 1,310 | Existing and in operation. |
| (m) Do. No. 3 | 144.5 | 21 | 1,310 | |
| (n) Do. No. 4 | 145.5 | 40 | 1,310 | |
| (o) Ivanhoe Furnace | 149 | 20 | 1,500 | |
| (p) Foster Falls | 158 | 40 | 1,600 | |
| (q) App. Pr. Co. No. 5 | 183.5 | 50 | 2,400 | Lies in pool of (r). |
| (r) Do. No. 6 | 186 | 110 | 2,400 | |
| (s) Ingles Falls | 188.5 | | | Conflicts with (r). |
| (t) App. Pr. Co., No. 8 | 250.5 | 75 | 3,930 | Lies in pool of (v). |
| (u) Do. No. 9 | 263.5 | 42 | | Do. |
| (v) Bluestone Res | 265.5 | 140 | 4,400 | Proj. No. 379, Prelim. Permit expired Oct. 25, 1926. |
| (w) Brook Falls | 276 | 22 | 6,140 | |
| (x) Sandstone Falls | 281 | 30 | | Proj. No. 423, Prelim. Permit expired Nov. 5, 1924. |
| (y) Slater | 302 | 50 | | |
| (z) Nuttallburg | 315 | 50 | | |
| (a1) Michigan | 318 | 50 | | |
| (z2) Hawks Nest | 322 | 98 | 6,800 | |
| (z3) Gauley Junction | 330 | 28 | | |

The Central Power Co., Project No. 542 N. C., applied for preliminary permit to construct power and diversion dams, diverting

the water through the divide into the Reddies River on the Atlantic slope. The permit was refused by the Federal Power Commission September 15, 1926.

3245 The Eastern States Development Co., Project No. 575, Va., N. C., applied for preliminary permit to construct a dam at the Oldtown site and divert water through the divide into the Fisher River on the Atlantic slope. The permit was refused by the Federal Power Commission September 15, 1926.

The Virginian Power Co. originally made preliminary locations of seven proposed developments (u to $z_1$). These sites were located after a general reconnaissance of the river but the surveys were not carried to the point of determining the most feasible locations. This company has now been absorbed by the Appalachian Electric Power Co.

8. Power capacity

From the duration curve submitted by the applicant, a discharge of 1,200 second-feet is available 90 percent of the time. With this and an average static head of 106 feet the power capacity of the project equals $0.08 \times 106. \times 1200. = 10{,}176$ h. p.

The development will probably be operated as a peak-load carrier in order to operate steam plants at a higher load factor. Under this condition the annual load factor of this plant may be as low as 35 or 40 percent while the annual load factor of the connected system is about 50 percent.

It is estimated that an average of 94.4 percent of the head available at full plant capacity will be utilized per annum. With this head the full plant capacity of 60,000 k. w. will require a discharge of

$$Q = \frac{60{,}000}{.678 \times 100} = 8{,}850 \text{ second-feet at } 80\% \text{ efficiency.}$$

The duration curve shows that this discharge is available 3.8 percent of the time. Thus 96.2 percent of the total flow can be used. The utilization factor is then equal to the product of head and flow used.

$$0.944 \times 0.962 = 0.908 \text{ or } 90.8\% = \text{utilization factor.}$$

9. Power market

The Appalachian Power Co., the basic company from which the Appalachian Electric Power Co. was formed on March 4, 1926, has supplied southwestern Virginia and southern West Virginia with power since 1912. With a total output of 40 million kilowatt-hours in 1913, the company has had a growth averaging 20 million

kilowatt-hours a year to 1925 and 27 million kilowatt-hours since 1920. The interconnected system of the Appalachian Electric Power Co. serves 266 communities with electric light and power in rapidly-growing and prosperous industrial, agricultural and coal-mining regions of Virginia, West Virginia and eastern Kentucky. The total population served is estimated to exceed 658,000.

It is believed that the territory served by the applicant through its interconnected system offers a good market for the power which will be developed at the proposed site.

The low production cost in this region of power from steam-electric plants prohibits the development of hydroelectric power at anything except plants whose economic feasibility cannot be
3246 questioned. It is probable that a company with such a large percentage of its capacity installed in steam generation would find it feasible to install hydroelectric capacity at a higher unit cost per kilowatt in order to operate its steam stations at a higher load factor, the hydroelectric plant being used as a peak-load carrier.

The applicant's financial ability is believed sufficiently strong to carry out the proposed development. A financial statement is given on page 16 of the application. The Appalachian Electric Power Co. is controlled by the American Gas and Electric Co. which is regarded as a sound corporation.

10. Accuracy of data

The data submitted with the application agrees with the facts found in the locality.

11. Additional data

The data submitted are sufficient for the consideration of the application. It is believed that the applicant should be required to furnish detail plans when they are completed

12. Time for completing project

The applicant has asked for one year from date of license to begin construction and four years from date of license to complete construction of the project works. This is believed to be a reasonable time and is recommended to be in the terms of a license.

13. Navigable stream

This office in its report on declaration of intention, July 23, 1925, for this project, stated in par. 6:

"It is the opinion of this office that the New River is a navigable stream as defined by the Federal Power Act and that the proposed

water-power project of the New River Development Company should be considered as coming under the jurisdiction of the Federal Power Commission."

The Division Engineer under 1st indorsement, July 25, 1925, stated,

"The Division Engineer concurs in the opinion of the District Engineer that the reach of New River under consideration comes under the jurisdiction of the Federal Waterpower Commission. This opinion is based primarily upon the fact that this reach of river was recommended to Congress for improvement after investigation under its authority, though not actually improved."

The Chief of Engineers subsequently in letter to the Executive Secretary, Federal Power Commission, August 20, 1925, stated,

"The fact that navigation does not exist at present is not understood to change the legal status of the stream. Congress has in the past signified its intention to assert jurisdiction of the New River by appropriating money for its improvement with a view to making the stream navigable, and it is not seen that the fact that the reversion to the Treasury of unexpended funds was later ordered alters its status."

3247 The Chief of Engineers later in letter to the Executive Secretary December 29, 1925, stated,

"I, therefore, conclude that New River is not at the present time a navigable water of the United States within the meaning of the Constitution and laws of Congress including Section 3 of the Federal Power Act."

Effect of navigation

The proposed project might effect the navigable capacity of the Kanawha River in the following cases:

"The flow through the applicant's dam may be stopped or reduced while allowing the reservoir to fill at a time that the inflow from the basin below the dam was insufficient to maintain the pools at the various navigation dams.

"If the waves caused from the intermittent operation of the power plant continue downstream in large-enough size and duration they might cause,

'the raising and lowering of the Kanawha movable dams with each wave,

'extremely hazardous navigation through the chutes of the Kanawha due to the unnatural change in the river stage.'"

An incomplete study of the persistence of waves caused by the operation of the power plant at Ivanhoe, Va. (40 miles above the

proposed site) indicates that these waves persist for long distances downstream. It is probable that the larger waves from the proposed plant will have an adverse effect on navigation in the Kanawha River unless regulated at critical times.

14. Protection of navigation

The following requirements are regarded as necessary for the protection of navigation and it is recommended that they become a part of the license:

That the licensee shall pass continuously through its dam during and after construction a flow not less than the minimum natural flow as determined from a gaging station to be established by them in New River above and sufficiently close to the reservoir created by the project works.

That the operations of the licensee, so far as they effect the use, storage and discharge from storage of the waters of New River, shall at all times be controlled by such reasonable rules and regulations as the Secretary of War may prescribe in the interests of navigation and as the Federal Power Commission may prescribe in the interests of flood control, damage to other interests and for the fullest practicable utilization of the waters of the said river for power purposes.

15. Public lands

The project does not contemplate the use of public lands or other Government property.

3248 16. Government reservation

The project is not on a Government reservation.

17. Government dam

The project does not contemplate the use of a Government dam.

18. Utilization of resources

The plan submitted is believed to be the best adapted to develop, conserve, and utilize in the public interest the navigation and water resources of the region.

A dam site exists at Ingles Falls 2½ miles below the proposed location. The use of this site would give the advantage of more head and an increase in discharge due to the addition of 285 square miles of drainage area from the Little River. This is manifestly infeasible since the pool created would submerge the towns of

Graysonton and Snowville and the Radford municipal power plant on Little River and destroy a valuable limestone quarry and crusher plant on New River immediately above the mouth of Little River. A value of $700,000 has been placed on this property.

The Appalachian Electric Power Co. has several power sites along New River and since they have acquired the properties of the Virginian Power Co., permittees for Project No. 379, Va., W. Va., (v) in Section 7 of this report, they will in all probability be the most extensive developers of the power resources of New River. In view of these facts the company is more interested in the best plan of development of the power resources of New River than would otherwise seem.

The applicant proposes a drawdown in their reservoir of 10 feet. This provides a storage of 40,000 acre-feet which is a small part of the contents of the reservoir. The maintenance of a head as high as possible is necessary for a high utilization of the resources. However, the wisdom in placing the intake of the lowest power penstock 10 feet below the normal pool surface is doubtful. It is therefore recommended that the applicant be required to place at least one of the power penstock intakes sufficiently low so that the reservoir may be drawn down considerably more in the event of a very long and extended drought, when it would be desirable to use more than the water stored in the top 10 feet of the pool.

### 19. Safety of structures

Analysis of the designs submitted as Exhibit "L" in the application shows adequate provision for safety in design for the dam and spillway. With the flashboards removed the spillway and flood gate section will pass a flood of 62.5 second-feet per square mile of drainage area with the pool 2 feet above normal. The estimated maximum discharge for the 1916 flood was 42 second-feet per square mile and the 1,878 flood (the highest of record), 60 second-feet per square mile. It is therefore concluded that adequate spillway capacity has been provided in the designs submitted.

The applicant has made extensive exploration of the foundation at the dam site. The District Engineer in company with consulting engineers, inspected the site during these explorations. The strata show clear evidence of the cementation by the intrusion of calcite. (See Section 2.)

3249 Consideration of the geology of the region and examination of the foundation show no inherent reason that the foundation will be unsafe for a dam such as proposed.

The firm Viele, Blackwell and Buck is acting as engineer for the project, and Colonel F. W. Scheidenhelm of Mead and Scheidenhelm is being retained as consulting engineer. These firms have a national reputation and their approval of the foundation and structure is regarded as good evidence of the safety of the project works.

20. Development by the United States

The development should not be undertaken by the United States.

21. Rental of Government dam

None. See Sections 16 and 17.

22. Headwater benefits

There is at present no storage project in New River above the proposed project. The licensee may at some future date benefit from the construction of a storage reservoir. The applicant proposes to install hydraulic and electrical machinery that will enable them to utilize upwards of 96 percent of the flow of New River at their plant. In the event that such a reservoir was constructed by other parties the principal benefits to the applicant would be those of a higher utilization of the annual flow and the utilization in the low water season of a larger percentage of the annual flow than could be made without such storage. The latter benefit would be difficult of determination owing to the fact that the Appalachian Electric Power Co. have a relatively high percentage of steam capacity and would likely figure a kilowatt-hour developed from storage water during low water season of no greater value than a kilowatt-hour developed from the natural flow of the river in high-water season.

The proposed project provides a storage of 40,000 acre-feet which is the equivalent of 667 second-feet flowing for one month. The very irregular occurrence of the low-water season with its irregular amount of flow precludes any appreciable benefit from this amount of storage other than in a season of extremely low flow of considerable duration.

The plant of the Electro-Metallurgical Co. at Kanawha Falls (about 150 miles downstream), might be benefited by the release of storage from the applicant's pool. On the other hand, it might be damaged by the applicant's holding back water from the natural run of the stream. The Kanawha Falls plant is a legal structure but does not hold a Federal Power license. Under such condition it is doubtful if they could be charged for benefits received from the

applicant's project. This company has protested the granting of license to the applicant unless the applicant's plant be operated so as not to damage them. It is believed that the recommended provisions of the license will minimize the possibility of such damage. In any case the Electro-Metallurgical Co. has redress in the civil courts for any damage suffered.

### 23. Desirability of project

The project is desirable and justifiable in the public interest for the purpose of improving the New-Kanawha River for the benefit of interstate commerce, to the extent that any increase of low-water flow will favorably affect navigation. The project is also justifiable to the extent that in creating a pool 19 miles long
3250 it renders this reach susceptible of navigation.

### 24. Protests

Protests to the granting of a license have been received from the following:

1. Public Service Commission of West Virginia (inclosure No. 7 with letter of transmittal).
2. Norfolk and Western Railway Co. (pages 7 to 9 in minutes of public hearing).
3. Virginian Railway Co. (pages 9 to 11 minutes of public hearing).
4. Electro-Metallurgical Co. (pages 12 to 14 in minutes of public hearing).
5. Oren F. Dodds (inclosure No. 11 with letter of transmittal).
6. Kanawha River Improvement Association (inclosure No. 12 with letter of transmittal).

All of the protestants request protection from damage by the operation of the applicant's project works. The rights of the protestants in this respect are governed and protected under State and Federal laws. It is believed that the recommended provisions of the license will minimize the possibility of damage from the operation of the project works.

The protest of the Kanawha River Improvement Association is on the grounds of protection to navigation. It is believed that the provisions that the licensee pass continuously the minimum natural flow and that the operations of the licensee shall be controlled by such reasonable rules and regulations as the Secretary of War may prescribe in the interests of navigation, protect all navigation interests.

25. Recommendation

It is recommended that the license be granted.

26. Special conditions

It is recommended that the following provisions be inserted in the license.

1. The licensee shall furnish detail plans of all structures when such plans are completed for approval by the Federal Power Commission.

2. The licensee shall establish and maintain a stream gaging station with automatic recording gage in New River above the reservoir created by the project works.

3. The licensee shall clear the reservoir area of all trees and brush between elevations 1830 and 1841 to the satisfaction of the Secretary of War and the Federal Power Commission.

3251 4. The licensee shall pass continuously through its dam during and after construction a flow not less than the minimum natural flow as determined from a gaging station to be established by them in New River above and sufficiently close to the reservoir created by project works.

5. The operations of the licensee so far as they effect the use, storage and discharge from storage of the waters of New River, shall at all times be controlled by such reasonable rules and regulations as the Secretary of War may prescribe in the interests of navigation and as the Federal Power Commission may prescribe in the interests of flood control, damage to other interests and for the fullest practicable utilization of the waters of the said river for power purposes.

(Sgn) H. M. TRIPPE.
H. M. Trippe,
*Major, Corps of Engineers,*
*District Engineer.*

Attached hereto are the following:
Exhibit "A."
Summary of contents.
Index.

3253 Summary of Contents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3256 (Views of the Division Engineer on report of District Engineer, Huntington, W. Va. dated Dec. 22, 1926, on Application for License for Proposed Power Development in the New River in Pulaski County, Virginia, by the Appalachian Electric Power Co., Project No. 739, Virginia.)

1st Ind. CWK/a.

Office Div. Engr., Cent. Div., Jan. 13, 1927,

To the CHIEF OF ENGINEERS:

1. This report has been carefully examined in this office and the Division Engineer concurs in the conclusions and recommendations of the District Engineer.

(Sgn) C. W. Kutz.
C. W. Kutz,
*Col., Corps of Engineers,*
*Division Engineer.*

Incls.
Exhibit A;
Summary;
Index.

3257 *Government exhibit No. 89*

LIST OF AFFIDAVITS SUBMITTED BY NEW RIVER DEVELOPMENT CO. TO FEDERAL POWER COMMISSION FOR CONSIDERATION UPON ITS DECLARATION OF INTENTION

| Affiant | Status | Summary of Affidavit |
|---|---|---|
| K. E. Harman | President, Pulaski National Bank; Chairman, Board of Supervisors of Pulaski County. | "Port Barrel" nature of appropriations; unsuccessful attempts at navigation abandoned before construction of railroads; two-thirds of course of river consists of riffles, falls and rapids; no navigation. |
| E. W. Calfee | Mayor, Town of Pulaski, Va. | Unsuccessful attempts at navigation; channel made by Government now filled up, of no value to navigation. |
| Dr. J. W. Holmes | Farmer, Pulaski County, Va. | Intimately familiar with conditions on river; for two-thirds of distance through Wythe and Pulaski Counties consisting of swift shoal water; personal recollection of improvements by Federal Government, unsuccessful attempt at navigation; no remaining evidence of improvements except notches cut through ledges. |
| J. F. Wysor | Treasurer, Pulaski County | Attempt at navigation after Federal improvements abandoned because of impracticability. |
| E. T. Pratt | Manager, Rex Milling Co., Draper, Va. | Attempt at navigation abandoned; improvement of no benefit. |
| W. C. Jennings | Farmer, Pulaski Co. | Attempt at navigation unsuccessful; channel deteriorated; river impracticable for navigation. |
| 3258 J. R. Linkous | Farmer operating ferry on New River, Pulaski Co., Va. | Navigation by gasoline launch from Radford to Linkous Ferry abandoned as impracticable, river not navigable; no need for navigation; navigation in interstate commerce impossible. |
| J. L. Ingles | Farmer, Montgomery Co., Va. | Reviews conditions on river disclosed by canoe trips from Foster's Falls, Wythe County, to Hinton, W. Va., showing navigation entirely impracticable. |
| William Ingles | Cashier, 1st National Bank, Radford, Va. | Same experience on New River. |
| J. G. Osborne | Former Superintendent Pulaski Division, Norfolk & Western Railway; Director People's Bank of Radford. | No freight hauled over river except small tonnage of lead and iron attempted to be transported to New River Depot soon after improvements; further attempts abandoned. |
| W. H. Painter | Council Member, City of Radford. | No navigation. |

*Government exhibit No. 99—Continued*

| Affiant | Status | Summary of Affidavit |
|---|---|---|
| William Adair | Resident, Narrows, Giles Co., Va. | In 81 years has seen no interstate commerce by New River between Virginia and West Virginia; navigation on river not practicable, nor beneficial since mountainous country precludes bringing products to river. |
| John A. Adair | Resident, Lurich, Giles Co., Va. | In 74 years saw no freight transported between Virginia and West Virginia by river; impracticable because of swiftness of river; no expenditure of Federal funds in Giles County, Va. |
| J. L. Boggess | Merchant, Narrows, Giles Co., Va. | Series of falls makes navigation impossible. |
| W. W. Walker | Treasurer, Giles County, Va. | Rapids and great fall of river preclude use for navigation. |
| J. H. Wyse | Engineer Superintendent of Roads, Giles Co., Va. | Falls preclude navigation. |
| 3259 W. P. Bowling | Merchant, Tophet, Summers Co., West Virginia; Deputy Sheriff of County. | Reviews unsuccessful attempt at navigation from Hinton upstream; navigation even by bateaux now impracticable. |
| R. C. Haynes | Mayor, City of Avis, Summers County, W. Va. | Channel attempted to be made zigzags across river between heavy ledges; not successful, now filled up and of no benefit; timber now removed from section and no necessity for navigation; navigation below Hinton entirely impossible. |
| J. G. Fredeking | Manager various industries at Hinton, W. Va. | Owing to interest in navigation on Kanawha, is familiar with flowage conditions; any operation of hydroelectric plant in Pulaski County could not possible affect navigability of Kanawha. |
| Joseph M. Meador | Former County Clerk; now in business. | Falls prevent navigation. |
| C. A. Templeton | President, Chamber of Commerce of Hinton, W. Va. | No local navigation above Hinton on account of shoals, rapids and falls; no evidence remaining of Government improvement except few notches or sluices in Falls; improvement of river for navigation would not create any freight due to mountainous character of adjacent country. |

3260 STATE OF VIRGINIA,

*County of Pulaski, to wit:*

I, K. E. Harman, being duly sworn says as follows: I am sixty-two years of age, and was born and raised in Pulaski County, Virginia. I have resided for the past twenty (20) years in the Town of Pulaski. I am President of the Pulaski National Bank, and Chairman of the Board of Supervisors of Pulaski County, Virginia, and have been Chairman of the Board of Supervisors for the past fourteen (14) years;

I further state that my duties as Chairman of the Board of Supervisors and my private business as a farmer and stock man have frequently taken me along the course of New River in the County of Pulaski, Virginia, and that I intimately know New River where the same flows through the Counties of Wythe, Pulaski, and Giles in the State of Virginia; and that New River through said Counties has a great deal of fall, and that at least two-thirds of its course is riffles, falls, and rapids, and that I personally know that there is no local navigation of the River

in these Counties and that during my recollection covering a period of forty-five (45) years, that there has been no commerce or navigation on New River between Virginia and West Virginia; that I personally remember the Government expending money on the River between the years 1873 and 1884 or 1885, and that soon after the completion of this Government work a small quantity of lead was boated from Austinville, or the Lead Mines in Wythe County to New River Depot in Pulaski County; and that a small tonnage of charcoal iron was hauled from the mouth of Max Creek in Pulaski County, to New River Depot, in keel bottom boats, but the Cripple Creek or North Carolina branch of the Norfolk & Western Railroad was built in 1884, and that even before the building of this road the hauling of iron
3261 and lead on the River was abandoned on account of it being practically impossible to pole the keel bottom boats back up the River; and that since then there has been no local navigation of the River whatever.

I further state that General W. T. Terry, who then represented this District in Congress, joked about securing this appropriation for the River and too heard him admit that there was no necessity for it, but that other sections were getting appropriations and he thought he would get this appropriation for his people, too.

I further state that the development of New River as a navigable stream, even if it was possible so to do, would not develop any new freight in this section, and the territory traversed by New River has adequate freight facilities over the Norfolk & Western and Virginian Railroads, and that in my opinion that any development of New River for purposes of traffic, would be an absolutely useless and foolish expenditure of money.

Given under my hand this 10th day of October, 1925.

(Signed) K. E. HARMAN.

VIRGINIA,

*Pulaski County, to wit:*

Taken, subscribed and sworn to before me this 10th day of October, 1925.

Given under my hand and official seal.

(Signed) ALINE STUART, N. P.

My Commission Expires July 25, 1928.

3262 VIRGINIA,

*County of Pulaski, to wit:*

I, Aline Stuart, a Notary Public in and for the County and State aforesaid do hereby certify that E. W. Calfee, this day

personally appeared before me in my county aforesaid and made affidavit that he is thirty-five years of age; that he has been Mayor of the Town of Pulaski, Virginia, for the past twelve (12) years, and that the Town of Pulaski is situate in the County of Pulaski, and is the terminus of the North Carolina extension of the Norfolk & Western Railroad, sometimes called the Cripple Creek Railroad; and that the Town of Pulaski is eight (8) miles west of New River; that he is familiar with New River where the same flows through the Counties of Wythe, Pulaski, Montgomery and Giles, and that there is a series of falls, riffles or shoals in the River along its entire course through the aforesaid counties; and that the only navigation the affiant has ever heard of was a futile attempt made to transport lead from the Wytheville Lead & Zinc Mines in Wythe County, Virginia, to New River Depot, in Pulaski County, Virginia, and a similar attempt to transport pig-iron from the mouth of Max Creek in Pulaski County to New River. Both of these attempts being made about 1882, but being abandoned within a short time as impracticable; that below New River Depot, there is a series of falls and riffles in the Counties of Montgomery and Giles, and that interstate commerce on New River on account of the above stated conditions is impossible; that there has been no local navigation on the River except those that have been abandoned as above set forth.

The affiant states that the channel cut in the River by the Government between the years of 1873 and 1889 has filled up on account of ice freshets and other freshets in the River
3263 and is no longer of any value to navigation.

The affiant further states that the Cripple Creek Railroad as shown on the Dublin sheet of the United States Geological Survey, parallels New River from a point near Allisonia and has been extended since the issuance of said map to Galax in the County of Grayson; and that the Norfolk & Western Railroad as shown on said map parallels said River from Radford to Walton Junction in the County of Montgomery, and that since the issuance of said map that the River is parallel by the present main line of the Norfolk & Western from Walton Junction to Glen Lyn, near the West Virginia line on the north side of the River; and that the Virginian Railroad parallels the River on the south side thereof.

The affiant is familiar with the creation and shipment of freight in this section, and that the commercial needs of the section are adequately filled by Railroad transportation facilities; and that there is no need or demand for the improvement of the River

of the type which could be affected at a reasonable expense commensurate with the results to be obtained.

Given under my hand and Notarial Seal this 6th day of October, 1925.

(Signed) ALINE STUART, N. P.

My Commission Expires July 25, 1928.

3264 VIRGINIA,

*Pulaski County, to wit:*

I, Aline Stuart, a Notary Public in and for the County and State aforesaid do hereby certify that Dr. J. W. Holmes, this day personally appeared before me in my County aforesaid and made affidavit that he is seventy-seven years of age; that he owns a farm on New River in Pulaski County, Virginia, at what is known as Calfee's Ford; that he has lived in Pulaski County since 1854, and that he is familiar with New River through the counties of Wythe and Pulaski, Virginia; and that in his practice he has crossed said River in the Counties of Wythe and Pulaski, thousands of times; and that the River through the counties of Wythe and Pulaski is full of shoals, riffles, and falls with only about one-third of the distance pool or still water, and the remaining two-thirds swift shoal water; that he remembers distinctly an attempt to improve the River which was in charge of a Col. Smith. This improvement being done in the seventies and early eighties; and that the channel was cut through the riffles and falls in an attempt to give the keel bottom boats a draft of two feet;

The affiant states that from the Austinville Lead Mines in Wythe County to the Kanawha Falls, it is a distance of one hundred and fifty-nine (159) miles, and five hundred nineteen feet (519) fall in that distance.

The affiant further states that after the above channel was cut that an attempt was made to transport lead from Austinville in Wythe County in keel bottom boats to New River Depot in Pulaski County; and that several trips were made with these keel bottom boats but owing to the fact that the boats continually wrecked in

going over the falls and through the rapids and also due to
3265 the fact that it was almost impossible to get the boats back up the River, this project was discontinued in less than a year from the time it began, and with this exception, the affiant has seen no navigation on the River in the Counties of Wythe and Pulaski, with the exception of an attempt to haul pig-iron from the Radford Furnace in Pulaski County, shown on the map attached to this affidavit, to New River Depot, which is also shown on said map; but that this effort proved impracticable for the same reason that the transportation of lead as aforesaid failed.

The affiant remembers that several boats and a great deal of iron was lost in the River in Pulaski County between the Radford Furnace and New River Depot; and that a good deal of pig-iron is still in the River at a point in the River known as Wygal's-Notch, at a locality on said River in the neighborhood of Haw's Branch as shown on the map; and that this project was also abandoned in a few months as impracticable.

The affiant states that the Cripple Creek road, shown on the map, was built in 1884, and that after building of said road, that there was no necessity whatever for the transportation of any freight by way of the River; and that all previous attempts to transport freight on the River was abandoned as impracticable.

The affiant further states that due to ice freshets and floods in the River, that the channel cut by the Government is practically filled up through the counties of Wythe and Pulaski; and that no evidence remains of it except a few notches cut through ledges where the water was very swift.

The affiant further states that for the above reasons that interstate commerce between Virginia and West Virginia on said River is impossible, and the affiant further states that even if said River was improved for navigation, that owing to the fact that the
3266 River is parallel by railroads, that the improvement of it would not develop any new freight; and that the cost of transportation of any freight on the River would be far out of proportion to the enormous expenditures which would be necessary to improve the River for navigation.

Given under my hand and Notarial Seal this the 6th day of October, 1925.

(Signed) ALINE STUART, *N. P.*

My Commission Expires July 25, 1928.

3267 VIRGINIA,

*County of Pulaski, to wit:*

I, Aline Stuart, a Notary Public in and for the County and State aforesaid do hereby certify that E. T. Pratt this day personally appeared before me in my county aforesaid and made affidavit that he is fifty years of age; that he was born and raised in Pulaski County, Virginia, near New River, and that he is Manager of the Rex Milling Company at Draper, Virginia; and that he is familiar with the course of New River through the counties of Wythe, Pulaski and Giles; and that there has been no navigation or attempt of navigation on New River in his recollection covering the past forty years; and that the only navigation he ever heard of on said River was an attempt to transport lead from Austinville and iron from Radford Furnace to New River Depot; and that he is reliably informed that this was abandoned in a short time on account of being impracticable.

The affiant states that the old channel which was cut in the River by the Government years ago has entirely filled up with the exception of a few notches in falls.

The affiant further states that he is familiar with the creation and transportation of freight in this section, and that owing to Railroad facilities that there is no occasion for New River ever being navigated, in event that it should be improved, and that owing to the tremendous fall that in the affiant's opinion that any sum spent to make the River navigable would be a useless expenditure of money and would not create any new freight or aid in the transportation or existing freight.

The affiant further states that interstate navigation on said River is impossible, and that there is absolutely no local navigation of the River.

3268 The affiant further states that for the above reasons that there is no local navigation of the River, and that interstate commerce on the River through said counties to West Virginia, is impossible.

The affiant states that he is familiar with the creation and transportation of freight in this section, and that owing to the River being practically paralleled by the Norfolk & Western and Virginian Railroads in said counties, that there is no necessity or reason for improving the River for navigation, even if practicable; that owing to the great fall in the River that the immense sum which would have to be spent to make said River navigable, if possible, would render prohibitive any such project.

Given under my hand and Notarial Seal this the 7th day of October, 1925.

(Signed) ALINE STUART, *N. P.*

My Commission Expires July 25, 1928.

3269 VIRGINIA,

*County of Pulaski, to wit:*

I, Aline Stuart, a Notary Public in and for the County and State aforesaid do hereby certify that J. F. Wysor this day personally appeared before me in my County aforesaid and made oath that he is forty-four years of age; that he is Treasurer of the County of Pulaski, Virginia, and has been for the past nineteen (19) years; and that he has always resided in the County of Pulaski, and that his duties as Treasurer and general business activities has made him familiar with the courses of New River through the Counties of Wythe, Pulaski and Giles, and that New River in breaking through the mountains in these counties has a great deal of fall, and that at frequent intervals and practically every mile of the River through said counties, there are falls,

riffles and shoals; that there is no local navigation of said River in said counties; and that the only freight that the affiant has ever heard of being transported on the River in these counties was lead from the Wythe Lead & Zinc Mines in Wythe County, Virginia, and pig-iron from the mouth of Max Creek in Pulaski County, Virginia, to New River Depot. This being done over forty (40) years ago before the Cripple Creek road was built and for a short time after the Government dredged a channel in New River for keel bottom boats of light draft.

The affiant further states that he has always heard that this was abandoned on account of being impracticable before the North Carolina branch of the Norfolk & Western Railroad was built, and that after said branch line was built, that no attempt whatever was made to transport freight on the River.

The affiant further states that the channel cut by the Government in said River has long since filled up with rock and other debris, and it is impossible to locate same except a
3270 few notches cut through riffles or falls.

Given under my hand and Notarial Seal this the 7th day of October 1925.

(Signed) ALINE STUART, *N. P.*

My Commission Expires July 25, 1928.

3271 VIRGINIA,

*County of Pulaski, to wit:*

I, Aline Stuart, a Notary Public in and for the County and State aforesaid do hereby certify that W. C. Jennings, this day personally appeared before me in my county aforesaid and made affidavit that he is fifty-three years of age; that he is a farmer by occupation, and owns a farm containing 333 acres, situate on New River in the County of Pulaski, about four (4) miles down stream from the bridge across said River at Hiwassie, Virginia; that he has lived on said farm for the past thirty (30) years; that his house is in plain view of New River, and that he is familiar with New River where the same flows through the counties of Wythe, Pulaski, Montgomery and Giles, and that there are a number of falls or riffles at short intervals all through said counties, and that opposite his house said River falls five (5) feet within one-half a mile; and that there has never been any navigation on New River since the affiant has lived on it for the past thirty (30) years; and that the only navigation he ever heard of on said River was an unsuccessful attempt to boat lead from the Wytheville Lead & Zinc Mines, and iron from the mouth of Max Creek in Pulaski County, to New River Depot in said County. This being done shortly after a channel was cut in said River about the year 1880,

but that the attempt was given up on account of the rapid shoal water wrecking the boats, and it being almost impossible to get the boats back up the River.

The affiant further states that this old channel has entirely filled up with rock, gravel and other debris, and is not perceptible at all in the River except where the same has cut through solid rock in the falls or riffles.

3272 The affiant states that for the above stated reasons that New River is impracticable for local navigation in the counties of Wythe, Pulaski, Montgomery and Giles, and that for the same reasons, it is impossible to conduct interstate commerce or navigation on the River..

The affiant further states that he is familiar with the creation and transportation of farm products and other freight originating in this section, and that any Government expenditure on New River which would make the same navigable would not develop any additional freight, and that the cost of the same would in the affiant's opinion be prohibited.

Given under my hand and Notarial Seal this the 6th day of October, 1925.

(Signed) ALINE STUART, *N. P.*

My Commission Expires July 25, 1928.

3273 VIRGINIA,

*Pulaski County, to wit:*

I, Aline Stuart, a Notary Public in and for the County and State aforesaid do hereby certify that J. R. Linkous, this day personally appeared before me in my County aforesaid, and made affidavit that he is forty-five (45) years of age; that he is a farmer by occupation, and that he has resided for the past thirty (30) years at Linkous' Ferry on New River, In Pulaski County, Virginia, at a point on said River about eight (8) miles southwest of the Town of Pulaski, Virginia; that he has personally operated a ferry across New River known as Linkous' Ferry for the past nine (9) years; and that he helped his father operate said ferry for twenty-one (21) years prior to that time; that he lived in sight of said River and is familiar with the courses of the same through the counties of Grayson, Carroll, Wythe, Pulaski, Montgomery, Giles and to Glen Lyn at the West Virginia line; and that during that period, that the affiant has never seen any navigation of any kind on said River with the exception of a futile attempt made by a man named Dudley to run a gasoline launch from Radford to Linkous' Ferry in the County of Pulaski; Dudley only making two trips with his launch and

giving up the project on account of the River not being navigable for even a small launch.

The affiant states that the River is not navigable on account of numerous falls, shoals, and riffles. The affiant states that he was informed that a small quantity of iron was boated in keel bottom boats from the Radford Furnace in Pulaski to New River Depot many years ago but this project was abandoned as impracticable on account of the River not being navigable.

3274 The affiant further states that the North Carolina branch of the Norfolk & Western Railroad was built in 1884 or 1885, and that there is no need for navigation on the River, even if it was possible to improve the River for this purpose.

The affiant further states that he, in boating and fishing on the River through the County of Pulaski, is familiar with the channel cut in the River by the Government, and that this old channel has been entirely filled up, and that the only evidence of it now in the River is where the channel was cut through shoals or falls, and that the improvements made by the Government is no longer of any value to navigation.

The affiant further states that through nevigation on New River in interstate commerce is impossible, and to make it possible would require large expenditures of money far out of proportion to any benefit that might be derived therefrom; that the commercial needs of the country through which the River runs is adequately filled by railroad transportation facilities, and that there is no need or demand for improvement of the River.

Given under my hand and Notarial Seal this the 5th day of October, 1925.

ALINE STUART, N. P.

My Commission Expires July 25, 1928.

3275 STATE OF VIRGINIA,
*City of Radford, to wit:*

I, J. L. Ingles, do solemly swear that I am forty-nine years of age, that I reside in sight of and about a quarter of a mile from New River at Ingles Ferry, Montgomery County, Virginia; that I own a farm of 300 acres bordering on the river a distance of approximately one and one-half miles, that I was born and raised where I now reside; that I am President of the Peoples Bank of Radford, and that I am a farmer by occupation, and that I was twelve years Superintendent of the Virginia Iron, Coal & Coke Company Blast Furnace, Radford, Virginia, which is located on New River. I further state that I know New River from Foster's Falls in Wythe County, Virginia, to Hinton, in Summers County, West Virginia, and that I have fished along the

course of the river and gone down the river on several occasions in small canoes as far as Hinton. That at least two thirds of the course of the river is very swift with frequent falls, shoals and rapids. That between Foster's Fall and Ingles Ferry that there is scarcely a half a mile of the stretch of the river without a fall which is impassable for even a canoe of light draft, and that Ingles Falls, at Ingles Ferry, there is a six ft. drop in a quarter of a mile, and that the river is a series of rapids to Radford with a 20 feet drop. That from Radford to Pepper's Tunnell on the Norfolk & Western Ry., there is a series of rapids and falls all the way; and that at Parrott in Pulaski County, Virginia, at a place called Broad Shoals, that the river is over one-half mile wide and very shallow and filled with ledges of rock and that at the Pulaski-Giles line there is a fall of approximately six feet to seven feet, and that other shoals and falls occur at Burton & Pembroke, between Pembroke and Pearisburg and at what is called the Narrows in Giles County and that between Glenn Lynn in Virginia and Hinton in West Virginia, there is
3276 Shumate Fall, the Anderson Falls, and numerous other falls of considerable elevation, which makes it impossible for local navigation of the river. That during my residence on New River there has been no local or interstate navigation on the stream. That the Government did expend some money between the years 1873 and 1884 or 1885 on New River in an attempt to dredge a channel and make it navigable for boats of light draft, and that a small quantity of lead and pig-iron was hauled down the river after this channel was completed, but nothing up the river, and this was soon abandoned as impracticable and a great many of the boats were wrecked in this attempt, and that no attempt has been made at local navigation for the past 40 years. I further state that along about 1890 that I went to Minton, West Virginia, in a canoe about 30 feet long and about 2½ feet wide with a draft of about 6 inches, during a normal stage of the river and that I had great difficulty in getting down the river and had to get out in the water and force the boat over the rocks and had to leave my boat at Hinton on account of it being impossible to get it back. I further state that I am familiar with the shipment of freight in this section and that the section traversed by the Norfolk & Western Ry. between Hinton in West Virginia and Foster's Falls in Wythe County, Virginia, is amply taken care of by the Norfolk & Western Ry., the Virginian, and the C. & O. Railroads, and that no necessity exists for making New River navigable even if it could be made navigable, and that any sum of money appropriated for digging out the old channel or putting locks in the river on dredging it

would be for the reasons above stated an entirely useless expenditure of money and would develop no new freight; and from my observation, the river would have to be locked and dammed at least every two miles, which would render any project of this nature entirely unfeasible and impracticable.

Given under my hand this 12th day of October, 1925.

J. L. INGLES.

3277 STATE OF VIRGINIA,
*City of Radford, to wit:*

I, Mary Turner, a Notary Public in and for the City and State aforesaid, do hereby certify that J. L. Ingles, this day personally appeared before me in my City aforesaid and subscribed and made oath to the foregoing affidavit.

Given under my hand and notarial seal this 12th day of October 1925.

MARY TURNER, *Notary Public.*

My commission expires September 21, 1928.

3278 STATE OF VIRGINIA,
*City of Radford, to wit:*

I, William Ingles, after first being duly sworn, do say that I am forty-eight years of age, that I was born at Ingles Ferry on New River, and that Ingles Ferry was owned and operated by my father, A. L. Ingles, now deceased, that I lived within a few feet of the River until I was thirty years of age, and then moved down the River a few miles to the City of Radford, and have lived right on the banks of the river every since. That I am Cashier of the First National Bank of Radford, Virginia, and have been for a period of Five Years; that before I was cashier, I was Assistant Cashier for fifteen years, that I am familiar with the course of New River from Foster's Falls in Wythe County through Pulaski, Montgomery and Giles Counties and to Crump's Bottom in Monroe County. That during my life on the river that there has been no local navigation of the river in the past thirty years. That before my recollection I am informed that a small quantity of lead was boated in keel bottom boats from the lead mines at Austinville in Wythe County to New River Depot in Pulaski County, Virginia. That about the same time small quantities of iron was boated in similar boats from the mouth of Mack Creek in Pulaski County to New River Depot, and that the United States Government between the years 1873 and 1884 spent some money in dredging out a channel through shoals and making cuts in falls, in order to make the river navigable for small boats, but I am informed that the transportation of this iron and lead was soon abandoned and I have seen a great deal of the iron in the river

where the boats wrecked in coming down the river. I further state that there is a great number of falls in the river and that at least two-thirds of the river is rapids, shoals, and falls and that for the above reasons, there is no local navigation or traffic
3279 on the river and no interstate navigation between the States of Virginia and West Virginia. I have personally gone in a small canoe from Ingles Ferry in Pulaski County, Virginia to Crump's Bottom in Monroe County, West Virginia, in about 1892, in company with J. L. Ingles. We went when the river was about a normal stage and we encountered heavy falls at the Cloyd Place in Montgomery County and a fall at the drop of 7 or 8 feet at the Pulaski Giles County Line, and a series of falls through the County of Giles, and a very decided fall just below Narrows in Giles County, and a number in the County of Monroe above Crump's Bottom, these falls being known as Shumate's Falls. That we had a canoe about 25 feet long and 3½ feet wide, which drew about six inches of water, and we had great difficulty in many places in getting this boat down the river and were unable to get it back up the river at all, and had to leave it. I further state that in my opinion it would be thoroughly impracticable to canal and lock and dam New River on account of its falls and that even if this were practical, that the making of the river navigable would not create any new freight or be a practical route for the transportation of freight as the rivers through the Counties of Wythe, Pulaski, Montgomery and Giles in Virginia and Monroe and Summer Counties in West Virginia are practically parallel by the Norfolk & Western, Virginian, and the C. & O. Railroads, which furnish ample freight facilities for this section.

Given under my hand this the 12th day of October, 1925.

WM. INGLES.

3280 STATE OF VIRGINIA,
*City of Radford, to wit:*

I, Mary Turner, a Notary Public in and for the City and State aforesaid, do hereby certify that William Ingles this day personally appeared before me in my City aforesaid and subscribed and made oath to the foregoing affidavit.

Given under my hand and notarial seal this 12th day of October, 1925.

MARY TURNER, *Notary Public.*

My commission expires September 21, 1928.

3281 STATE OF VIRGINIA,
*City of Radford, to wit:*

I, J. G. Osborne, after first being duly sworn, do say that I am 71 years of age, that I have resided at Radford on New River, Vir-

ginia, for the past forty-two years, or since 1883. That I was for nine years Division Supt. of the Norfolk & Western Ry. Company of its Pulaski Division, which Division included the Norfolk & Western Ry. from Radford, Virginia to Bristol, Virginia, and the North Carolina Branch, sometimes known as Cripple Creek Road from Pulaski to Chestnut Yards. I was Supt. of the above road from May 15th, 1888 to May 1st, 1897. Prior to which time I was Division Engineer in the construction of the New River Branch of the Norfolk & Western Ry. from New River to Pocahontas. I am now retired from active business, but I am a director in the People's Bank of Radford and own real estate in the City of Radford.

I further state that my business in the past forty-two years has familiarized me with New River from Glenn-Lynn near the West Virginia line in the County of Giles up stream to Chestnut Yards in the County of Carroll, Virginia, and that I am more or less familiar with the River from Glenn-Lynn to Hinton, West Virginia, I further State that there is a tremendous fall in the river through the Counties of Grayson, Carrol, Wythe, Pulaski, Montgomery and Giles in the State of Virginia, and through Monroe and Summer Counties from Glenn-Lynn to Hinton and that at least two-thirds of the course of New River is falls, ripples, rapids, and shoal water. I further state that I remember that the government expended an appropriation on New River between New River Bridge and Ivanhoe, about 1882, dredging out a channel through various ripples for keel bottom boats of light draft, but practically no freight was hauled over the River after the improvement,
3282 except a small tonnage of lead, which I am informed was hauled down the river, and a small quantity of iron from the mouth of Mack's Creek in Pulaski County to New River Depot near the City of Radford on the line between Montgomery and Pulaski Counties, but that this was soon abandoned, and that during all of my intimate acquaintance with the river there has been no local navigation of the river or the hauling of freight thereon, and that there has been no interstate commerce between Virginia and West Virginia on the river and that the old channel cut by the Government has long since been filed up with rock and other debris, and that there is no possibility of local or interstate commerce on the river in its present condition, and that from my engineering experience and knowledge of the river, I am of the opinion that the expenditure of an amount necessary to lock and canal the river would be prohibitive for practical purpose, and in the event that the expenditure be made necessary to do this, that there would be absolutely no need as no new freight would be developed there by, and owing to the fact that the river in Southwest Virginia and West Virginia is practically parallel with the Norfolk & Western Ry.,

Virginian, and the C. & O. Railroads, this section has adequate freight facilities for the movement of all freight created therein. I further state that owing to the narrow vallies and gorges through which the river runs, and the high mountains adjacent thereto, that any attempt to bring freight to the river for transportation would be defeated by the topography of the country.

Given under my hand this 12th day of October 1925.

JHO. G. OSBORNE.

3283 STATE OF VIRGINIA,

*City of Radford, to wit:*

I, Mary Turner, a Notary Public in and for the City and State aforesaid, do hereby certify that J. G. Osborne, this day personally appeared before me in my City aforesaid and subscribed and made oath to the foregoing affidavit.

Given under my hand and notarial seal this 12th day of October 1925.

MARY TURNER, *Notary Public.*

My commission expires September 21st, 1928.

3284 STATE OF VIRGINIA,

*City of Radford, to wit:*

I, W. H. Painter, having been duly sworn, state that I am 55 years of age, and that I reside in the City of Radford, Virginia, and have for the past 15 years, that I am a member of the Council of the City of Radford, and that I am a builder and contractor and owner of real estate in the City of Radford; that I am a director in the Radford Real Estate & Insurance Company, and that I was born at Ivanhoe, Wythe County, Virginia, on New River, where I resided for 28 years, and that I am intimately acquainted with New River where the same flows through the Counties of Grayson, Carroll, Wythe, Pulaski, and Giles in the State of Virginia, and owing to the fall of New River through these counties where it breaks through the dividing mountains and ridges between the Allegheny and Blue Ridge Mountains, that at least two-thirds of the course of the river is rapids, falls, and shoals. I further state that on account of the above reasons, that there is no local navigation or the hauling of freight on the river in the above mentioned counties. That I remember as a boy the expenditure of the Government of an appropriation in an attempt to make the River navigable for keel bottom boats of light draft, and after the Government expended this money, a small quantity of lead was boated from Austinville in Wythe County to New River Depot near the City of Radford, and a small quantity of iron was also hauled by boats to the same point from the mouth of Mack's Creek, but that this was abandoned

as impracticable and that the channel which was dredged through falls and rippies, has long since filled up on account of ice-freshets and high water with rock and gravel and very few traces, if any, remain of the old channel, and that there has been no attempt to navigate the river since the old channel filled up. I further state that since the dredging of the old channel that the

Cripple Creek Road on the North Carolina Branch of the
3285 Norfolk & Western Railroad, extending from Pulaski,
Pulaski County, Virginia, to Galax in Grayson County, Virginia, has been constructed a distance of 52 miles; 40 miles of which road practically parallels the river, and that since 1880 the present main line of the Norfolk & Western Ry. has been projected from Walton; three miles down stream from Radford, practically parallel with the river, to Glenn-Lynn, a distance of approximately 40 miles and that the Virginian Railroad was built about twenty years or more ago, which parallels on said river practically it's entire distance through the Counties of Giles and Montgomery, and that these railroads furnish ample facilities for the handling of all freight in this section, and that if any money is spent to dredge out the old channel, or to lock and canal the river, would be a useless expenditure even if it were practical to make the river navigable as New River runs through narrow gorges and valleys, and owing to the height of the mountains on either side of it, it would be impracticable to bring any freight to it as a water way, even if the railroad transportation along the river was not, as in my opinion it is, quicker and cheaper transportation.

Given under my hand this 12th day of October 1925.

(Signed) W. H. PAINTER.

STATE OF VIRGINIA,
*City of Radford, to wit:*

I, Mary Turner, a Notary Public in and for the City and State aforesaid, do certify that W. H. Painter, this day personally appeared before me in my City aforesaid and subscribed and made oath to the foregoing affidavit.

Given under my hand and notarial seal this 12th day of October 1925.

(Signed) MARY TURNER, *Notary Public.*

My commission expires Spt. 21, 1928.

3286 VIRGINIA,
*Giles County, to wit:*

I, Wm. Adair, after having been duly sworn state that I am 81 years of age; that I reside at Narrows in Giles County, Virginia; and that I was born at Lurich in Giles County, Virginia, and that

I am now 81 years of age and have spent the entire 81 years on New River, and am familiar with the River the entire length of Pulaski, Giles and Summers counties; that in all my residence on the River I have never seen any local navigation in the county of Giles and have never seen any freight transported from Virginia down the River into West Virginia; and that it is impossible to do so on account of the swiftness of the River, the numerous falls across it, and the shoals and rapids where the River breaks through the numerous mountains and hills in Virginia and West Virginia. I further state that owing to the River being parallel with the Norfolk & Western and Virginian Railroads through Giles county that this section has ample freight facilities, and that making New River navigable would not develop any new or additional freight, and that owing to the River flowing through deep gorges and narrow vallies that it would not be practicable to bring any agricultural products for transportation by water; that the counties of Giles, Pulaski and the county of Summers in West Virginia, are principally grazing counties and produces very little surplus agricultural products that could not be as economically handled by rail.

Given under my hand this 13th day of October 1925.

(Signed) WM. ADAIR.

VIRGINIA,

*County of Giles, to wit:*

I, C. R. Adair, a Notary Public in and for the county and state aforesaid do hereby certify that William Adair this day personally appeared before me in my county aforesaid and subscribed and made oath to the foregoing affidavit.

Given under my hand and Notarial Seal this 13th day of October 1925.

(Signed) C. R. ADAIR, *N. P.*

My commission expires May 8th, 1928.

3287 VIRGINIA,

*County of Giles, to wit:*

I, John A. Adair, after having been first duly sworn state that I am 74 years of age; that I was born and raised at Lurich on New River in Giles County, and lived at Lurich for 72 years in sight of the River, and was in 300 yards of it; that I know the length of New River through Giles County and down through West Virginia to Hinton, West Virginia; that Lurich is by River 9 miles from the West Virginia line, and 2 miles by turnpike; that in all my residence on the River I have never seen any local navigation in the county of Giles, and have never seen any freight transported from Virginia down the River into West Virginia; and that it is impossible to do so on account of the swiftness of the

River; the numerous falls across it, and the shoals and rapids where the River breaks through the numerous mountains and hills in Virginia and West Virginia. I further state that the Government has never expended any money in the improvement of the River to my knowledge between the Bulls falls above Hinton and the Pulaski county line, and that any expenditure of money on the River in this section in my opinion would be absolutely useless on account of the tremendous sum which would be necessary to make the River navigable, if it could be made navigable at all.

Given under my hand this 13th day of October 1925.

(Signed) JOHN A. ADAIR.

STATE OF VIRGINIA,

*County of Giles, to wit:*

I, C. R. Adair, a Notary Public in and for the county and state aforesaid do hereby certify that John A. Adair this day personally appeared before me in my county aforesaid and subscribed and made oath to the foregoing affidavit.

Given under my hand and Notarial Seal this 13th day of October 1925.

(Signed) C. R. ADAIR, *N. P.*

My commission expires May 8th 1928

3288 VIRGINIA,

*County of Giles, to wit:*

I, J. L. Boggess, after having been first duly sworn state that I am sixty-eight years of age; that I reside on New River at Narrows in Giles County, Virginia, Narrows being thirteen (13) miles up stream from the West Virginia line; that I have resided at Narrows for the past 39 years; that I am now engaged in the retail hardware business and have been for the past fifteen years, and have been in the general mercantile business as long as I have resided at Narrows; and that my business has made me familiar with the entire course of New River where the same flows through the County of Giles; that there has never during my acquaintenance with the River been any local navigation or hauling of freight on it, and that there has never been any interstate navigation between Virginia and West Virginia; that at least two-thirds of the distance through Giles County is composed of falls, shoals and rapids, with a very occasional short stretch of eddy water; and that just below the Town of Narrows the falls in the Narrows between East River Mountain and Peters Mountain have a drop of at least six or seven feet, and that there are a series of falls down the River past Glenn Lynn through the County of Summers in West Virginia, the principal ones being Shumate, Anderson and Bulls falls; and that in my opinion that owing to the River

breaking through a series of mountains and high ridges and over frequent falls, it would be wholly impracticable, if not impossible, to dam and canal the River to make it navigable, and that even if this were practicable that owing to the River being parallel with the Norfolk and Western and Virginian Railroads through Giles counties, that this section has ample freight carrying facilities, and that making New River navigable would not develop any new or additional freight, and that owing to the River flowing through deep forges and narrow valleys that it would not be practicable to bring any agricultural products for transportation by water; that the Counties of Giles and Pulaski, and the County of Sum-
3289 mers in West Virginia, are principally grazing counties and produce very little surplus agricultural products that could not be as economically handled by rail.

Given under my hand this 13th day of October 1925.

(Signed) JNO L. BOGGESS.

STATE OF VIRGINIA,

*County of Giles, to wit:*

I, C. R. Adair, a notary public in and for the county and state aforesaid do hereby certify that J. L. Boggess this day personally appeared before me in my county aforesaid and subscribed and made oath to the foregoing affidavit.

Given under my hand and Notarial Seal this the 13th day of October 1925.

(Signed) C. R. ADAIR, *N. P.*

My Commission expires May 8th, 1928.

3290 VIRGINIA,

*County of Giles, to wit;*

I, W. W. Walker, after having been first duly sworn state that I am 52 years of age; that I was born and raised in Giles County on New River at Eggleston, Virginia; that I am now Treasurer of the county of Giles, and have been for a period of six (6) years; that I am also a farmer, and that I have lived my entire life within one (1) mile of New River and that I am intimately acquainted with New River where the same runs from Radford to Glen Lyn; that New River breaks through Cloyds Mountain on the Giles-Pulaski line and then through Peters Mountain, Buckeye Mountain, and East River Mountain in the county of Giles, and that just above the Giles County line at Parrott in Pulaski County, there is what is known as broad shoals where the River for a considerable distance is very wide and shallow, running over ledges of rock, to the Big or Macoy Falls and then there is a series of rapids and riffles below Burton on the Norfolk & Western Rail-

road, and that there are rapids from Goodwin's Ferry to Eggleston, a distance of about two (2) miles; and that there is a long stretch of rapids from Pembroke Station and then a series of rapids and falls on to Glen Lyn at the West Virginia line, with an occasional short stretch of eddy water.

I further state that owing to the tremendous fall of New River through Giles County that there is no local navigation on the River, and that the only boats on the River are ferry boats crossing the River and an occasional small canoe; and that there is no evidence in the River of any improvement or channel being cut in it.

I further state that the River is parallel with railroads on each side practically through the entire length of the county, and that there is no necessity for any attempt navigable, and that this in my opinion would be impossible owing to the fall in the River, and that any dams placed crossing the River for control could not make the River navigable on account of the fall
3291 and swiftness of the current, and that there is no necessity even if it could be navigable to do so on account of our present railroad freight facilities, and that the making of the River navigable would not create any new freight and that practically all timber along the River has been cut, and that there are no minerals adjacent to the River which could be transported.

I further state that the only use being made of the River through the county of Giles is as a water supply for tanneries at Pearisburg and Narrows; a steam rock crusher at Pembroke and Klots, and for the large Appalachian steam plant at Glen Lyn, and for the recently constructed Virginian Steam Plant at Narrows; and that no control of the River which would affect the intakes of these plants could be had during dry or extremely low water periods.

Given under my hand this 13th day of October 1925.

(Signed) W. W. WALKER.

VIRGINIA,

*County of Giles, to wit:*

I, Walker Williams, a notary public in and for the county and state aforesaid do hereby certify that W. W. Walker this day personally appeared before me in my county aforesaid and subscribed and made oath to the foregoing affidavit.

Given under my hand and Notarial Seal this the 13th day of October 1925.

(SEAL) (Signed) WALKER R. WILLIAMS, N. P.

My commission expires March 19, 1922.

3292 VIRGINIA,

*County of Giles, to wit:*

I, J. H. Wyse, after having been first duly sworn state that I am 44 years of age; that I have resided in Giles County for the past twenty years; that I am Engineer Superintendent of Roads for the County of Giles and have been for the past five (5) years; that I am by profession a civil engineer, and a graduate of Clemson A. & M. College of South Carolina, but I did engineering work for the Virginian Railroad in the County of Giles from 1904 until the fall of 1907; that the Virginian Railroad runs along New River from the Giles-Pulaski line to Glen Lyn on New River, a distance of approximately thirty-five (35) miles, the road being located about one foot above high water mark along the south side of the River.

I further state that my engineering work on the Virginian and my road work has thoroughly famil'arized me with the course of New River through the county of Giles; that there is a series of falls, riffles and rapids where the River breaks through Peter's Mountain, Butte Mountain, Big Walkers Mountain, and East River Mountain, and various ridges flanking the River on both sides; that there is an average fall of at least six (6) feet through the county, and that these falls occur with such frequency that navigation on the River is impossible; that I have never seen any local or interstate navigation on the River, and that in my opinion as an engineer it would be wholly impracticable to lock and canal the River for navigation as locks or dams would have to be placed so close together that the cost thereof would be prohibitive; and that a dam placed in the River for the purpose of flood or flowadge control would not aid navigation on account of frequent rapids which could not be negotiated by boats of any draft without great danger, it being practically impossible to get the boats back up stream.

I remember on one occasion while working for the Virginian that an attempt was made to bring a flat boat down the River when the River was at its normal state, and that this flat boat wrecked near Pembroke by plunging over a fall and had to be abandoned. This was the only attempt that I have ever seen to bring a boat down the River and I understand
3293 there was an attempt to take this boat to Hinton where it was to be sold.

I further state that even if it were practicable to lock and canal New River through the county of Giles that there would be no necessity for this being done as the River is practically parallel through Giles by both the Norfolk & Western and Virginian Railroads, and that no new freight would be developed by making

the River navigable, and that owing to the River breaking through the mountains in narrow gorges with high mountains on each side, that it would be impracticable to take farm products or freight from the adjacent territory to the River for transportation; that the county has ample railroad freight facilities and that all of the state highways and public road system is adapted to our present railroad transportation facilities; and that any expenditure of money on New River for the purpose of making it navigable would in my opinion be entirely useless and wholly impracticable.

Given under my hand this 13th day of October 1925.

(Signed) J. H. WYSE.

VIRGINIA,

*County of Giles, to wit:*

I, Walker Williams, a notary public in and for the county and state aforesaid do hereby certify that J. H. Wyse, this day personally appeared before me in my county aforesaid and subscribed and made oath to the foregoing affidavit.

Given under my hand and Notarial Seal this the 13th day of October 1925.

(Signed) WALKER A. WILLIAMS, *N. P.*

My commission expires March 19, 1927.

3294 STATE OF WEST VIRGINIA,

*Summers County, to wit:*

I, W. P. Bowling, on my oath state that I am fifty-eight years of age; that I was born in Mercer County, West Virginia; that for twenty-two years I resided at Tophet Post Office, Summers County, West Virginia and within two miles of New River, the nearest point being the mouth of Island Creek, during which time I was a merchant at Tophet and also owned a farm bordering on New River twenty-five miles south of Hinton and near the point locally known as "Shanklin's Gravel," and still own a tract of five hundred (500) acres bordering on New River in that locality; that I was Deputy Sheriff of Summers County from January 1, 1905, to December 31, 1908; that I was County Clerk of the same county from January 1, 1909, until December 31, 1914; that I was Mayor of Avis from 1918 to 1920, and that I am now Deputy Sheriff of Summers County; that on the 3rd day of March, 1909, I moved to the City of Hinton on New River where I have since resided and have been in the mercantile business, and for a time was manager of the New River Hardware Company, wholesale hardware, from April 16, 1916, until it was destroyed by fire February 7, 1918; and that since 1921 I have been in the retail hardware business.

I further state that my business, both as an official and in private life and private enterprises have brought me into thorough touch with all of the activities on New River from the Virginia line to Hinton all of my life. I moved to New River in 1887 and am familiar with the government work done on the river between Hinton and Glen Lynn and know that when it was first completed that it was not a success as a commercial enterprise; that a number of the citizens of Hinton constructed a boat to be operated on the river and after making a strenuous effort were only able to take the boat ten miles up the river to what is known as "Bulls Shoals," and after repeated efforts it could not be forced through the channel and the boat was returned to the landing at Hinton and permitted to lie idle and rot away; and that at that time none of the lumber had
3295 been removed along the river and a great deal of tobacco was raised and this was forced to be brought to Hinton in small bateaux owing to the shallowness of the channel and impassable roads, but that more than twenty years ago the people ceased to raise tobacco and that all of the commercial lumber has been removed except one small tract that is now being operated by J. G. Anderson above Bulls Falls which will be completely worked out in a few months and that the same is being brought to the railroad by wagons and trucks, it being impossible and impracticable to attempt to bring it by bateau or down New River.

I further state that the high waters and ice floes have caused the old channel to be filled up and that its present condition makes it as useless for navigation as it was before any improvements were made. I know that there is not a bateau or any means of bringing the products from that section by river to any market and there has not been any for years.

I also state that the river cuts through the high mountains, passes through a narrow gorge with very narrow strips of bottom land on either side on which nothing is produced that requires transportation and this applies to the entire territory from the Virginia line to Hinton.

My entire recollection is, and I am distinct in that, that there has been no interstate commerce between Virginia and West Virginia on New River since 1887, the length of time that I have known it, and I further state that interstate navigation has at all times been impossible and is now. The high mountains on either side of New River make it inaccessable to the country back of the same and all of the merchandise coming in and products going out from

the territory on top of the mountain go to the Virginia, Norfolk & Western or Chesapeake & Ohio Rail Way and especially in has been development of the state highways, and New River from Glen Lynn, Virginia, to Hinton, West Virginia is entirely useless and impracticable as a means of transportation or exchange of interstate commerce and that if improved by locks or canals, no new freight would be developed along its course and that owing to the tremendous fall in the river that the cost of making
3296 it navigable would make the hauling of freight on it prohibitive from a practical business standpoint.

I further state that there is no variation in the daily tides of the river caused by any dam up stream from this place.

Given under my hand and seal this the 9th day of October 1925.

[SEAL] (Signed) W. P. BOWLING.

Taken, subscribed, and sworn to before me this the 9th day of October 1925, and given under my hand and official seal.

(Signed) SALLY B. SAUNDUS,
*Notary Public.*

My commission expires on the 2nd day of November 1932.

3297 STATE OF WEST VIRGINIA,
*Summers County, to wit:*

I, R. C. Haynes, on my oath state that I am forty years of age and have resided on New River in Summers County, West Virginia, for thirty-two years; that I am the present Mayor of the City of Avis, and have known intimately the waters of New River from Hinton to the Virginia line all of the time which I have resided in Summers County; that I have been over the channel attempted to be constructed by the United States Government about fifty years ago and know that it never has been fit for practical use. It zigzags across the river between the heavier ledges in an attempt to secure sufficient water during normal tides for the passage of keel bottom boats, but when it was first built it was not a success and since then it has been filled with large stones brought in by freshets until its present condition so far as use is concerned is no better than before any improvement was made.

Before the state roads were improved or the Virginian Railway built about twenty years ago and while the timber was still on the watersheds bordering New River between Hinton and Glen Lynn, bateaux were used to carry lumber, staves, and a few farm products down the river to Hinton but this has long since been abandoned and there are no longer boats of this character on the river and no attempt to use the river for transportation.

The timber has all been removed and there is no necessity or demand for these boats and such as now exists is taken care of by trucks. The river has never been used for carrying merchandise to or from Virginia on the New River waters. It cannot now be so used nor can it be used from any point in Virginia to Hinton, West Virginia and from that point on to the west, navigation is entirely impossible until a point below Kanawha Falls where locks and dams are in existence. The territory between Hinton and Kanawha Falls is through mountainous gorges with the C & O Railway Company as close to the water's edge as is practical on account of high water and for many reasons, it would be impossible to attempt navigation of this river by locks and dams through this section.

3298 I have been over the river in all kinds of skiffs, flat-bottom boats and bateaux and know that from Harvey's Ledge near Anderson's Falls to Hinton that the waters of the river pass through shallow channels, rapids, between ledges of rock and over falls continuously and is of that character that no reasonable investment could convert into any system of transportation and one that would not be sanctioned by business men of any section.

The productive lands adjacent to the river are narrow bottoms and all facilities for handling the harvests are adequately taken care of by public roads and none of the adjacent territory is more than fifteen miles from a railroad.

Given under my hand and seal this the 9th day of October 1925.

[SEAL] (Signed) R. C. HAYES.

Taken, subscribed, and sworn to before me and given under my hand and official seal this the 9th day of October 1925.

(Signed) SALLY B. SAUNDERS,
*Notary Public.*

My commission expires on the 2nd day of November 1932.

3299 STATE OF WEST VIRGINIA,
County of Summers, to wit:

J. G. Fredeking, being sworn, says as follows:

I am twenty-nine years of age and at present I am General Manager of the Hinton Water, Light & Supply Company, Hinton Insurance Agency, Quinnimont Ice Company, Alderson Ice Company, and City Ice Company of Hinton, West Virginia; that in 1923, I was General Manager of the West Virginia Sand & Gravel Company at Charleston, West Virginia, which had its plant located on the banks of Elk River; that it also had a

dredging boat and pump boat in the Ohio River near Point Pleasant, West Virginia, and that they continuously operated the steam boat ("Mary Jane") between Charleston, West Virginia, and eight miles above Point Pleasant, West Virginia, and that in addition to operating the steamer owned by the company in towing barges, they also employed a steamer ("Western") owned by the Western Rivers Sand Company; that by reason of the operation of this plant and towing from near Point Pleasant to the plant at Charleston that I constantly studied the stages of the waters of New, Elk, and Kanawha Rivers; that there was ample water for navigation in the Kanawha and Ohio Rivers between the points above indicated; and that in my opinion any operation of a hydro-electric plant on New River in the County of Pulaski, Virginia, could not possibly affect the navigability of the river where I was familiar with.

I am informed that only twenty-eight (28) percent of the drainage area of New River is above the proposed project of the New River Development Company in the County of Pulaski, Virginia; that in my opinion the remaining seventy-two (72) percent of drainage would be amply sufficient for all purposes of navigation below Kanawha Falls in the Kanawha River. My observation of the different stages of water in the Elk, Kanawha, Ohio, and New Rivers was such that I found the flow of water in New River to be about normal with that from the other rivers.

I further state that the water plant which I now operate in Hinton, West Virginia, is at the point where the govern-
3300 ment improvement was made in the river many years ago and that I am familiar with the course of New River through the County of Summers to Anderson's Falls in said county and that the old channel cut in the river by the government has filled up and that there is no local navigation of the river in the County of Summers, and that no freight of any kind is delivered at the old Hinton landing at the beginning of said channel and that there is no interstate commerce between Virginia and West Virginia on said river, and that the river flows through a section which has no mineral or coal and produces no freight which could be taken care of by river navigation in the event of the improvement of the river and that this section has ample railroad freight facilities over the Virginian and C. & O. Railroads and that any improvement to the river for navigation would, in my opinion, be entirely useless and at a cost which would make it prohibitive.

I further state that there is no variance in the flow of the river except that caused by rainfall.

Given under my hand and seal this the 9th day of October 1925.

[SEAL] (Signed) J. G. FREDEKING.

Taken, subscribed, and sworn to before me this the 9th day of October 1925, and given under my hand and official seal.

(Signed) SALLY B. SAUNDERS,
*Notary Public.*

My commission expires on the 2nd day of November 1932.

3301 STATE OF WEST VIRGINIA,
*Summers County, to wit:*

I, Joseph M. Meador, on my oath state that I am sixty years of age, was born and raised in Summers County, West Virginia, near Pipestem, and resided for a number of years at Mercer Salt Works on the banks of New River where for seven years, from 1890 to 1897, I conducted a mercantile business; that thereafter I became Deputy County Clerk of Summers County remaining as such until January, 1903, when I became the County Clerk by election and held this position until 1909. Thereafter, I have been in various business occupations in the City of Hinton and am now in charge of an insurance agency.

I have known intimately the territory through which New River runs in West Virginia, and was familiar with the attempt of the government to develop a channel from Hinton to the Virginia line, an entirely useless expenditure being made by the government for this purpose between the years 1873 and 1889. This channel, which was then cut, has practically filled up with stone and other debris and very few traces of it now remain.

The fall of the river through Summers County is very great, beginning at Wylie's Falls about three miles below Glen Lynn in Virginia, and thence through Shanklin's Gravel with a wide, shallow stream to Anderson's Falls about one half mile below Mercer Salt Works, then in a continuation of shoals and rapids to Bull Falls about eight miles below Mercer Salt Works, and from thence to Bluestone Shoals, which is rapid in flow and shallow in depth, and from thence to Hinton it is practically the same way.

From the point of development in Hinton, by Hinton, it flows through channels of rocks with shallow depth and passes on through rapids to Brooks Falls about four miles west of Hinton, thence with a continuous increase in flow, it reaches Sandstone Falls eight miles west of Hinton and from thence down New River it empties into a gorge tortuous, swift, around boulders and

impossible of any navigation to Gauley Bridge, the entire territory in Summers County adjacent to the river being mountainous and there being no minerals, including coal, contiguous
3302 to the river and the timber resources accessible to the river being almost entirely exhausted.

I further state that for the above reasons there is no local navigation of the river and that there has never been any interstate navigation and that owing to the location of the railroads that this section has adequate freight facilities and that the improvement to New River so as to make the same navigable, if possible, would not develop any freight which could not be transported on the railroads at a cheaper rate and a greater saving in time.

I further state that in my opinion locking and canalling of the river would seriously interfere with the Chesapeake & Ohio Railway from Hinton west and that any further money spent in an attempt to make the river navigable or to restore the old channel would be absolute waste.

I further state that in my opinion in the event hydro-electric dams are placed on the river above Hinton that the flood control, if any, as had by said dams would be very beneficial to the riparian owners along New River on account of impounding flood waters during flood periods and preventing the rapid rise of the river and the damage resulting therefrom.

Given under my hand and seal this the 12th day of October 1925.

[SEAL] (Signed) J. M. MEADOR.

Taken, subscribed, and sworn to, and given under my hand and official seal this the 12th day of October 1925.

(Signed) SALLY B. SAUNDERS,
*Notary Public.*

My commission expires on the 2nd day of November 1932.

3303 STATE OF WEST VIRGINIA,
*Summers County, to wit:*

C. A. Templeton, being duly sworn says as follows:

I am forty-four years of age and have resided at Hinton in Summers County, West Virginia, continuously for thirty-two years; that I have been in the mercantile business since sixteen years of age and was manager of the department store of Plumley-Hulme Company until their sale to the Midland Stores; that I am now and have been for two years president of the Chamber of Commerce of Hinton; that I am thoroughly familiar with New River in the County of Summers, West Virginia, and also with the river from Hinton to Charleston; that no improvements have

been made or no attempt has been made to navigate the river from Hinton to Kanawha Falls on account of the rapid fall in the river, which falls include Brooks, Sandstone, and other falls, and the rapids in the river from Thurmond to Gauley Bridge, this stretch of the river being entirely impracticable for navigation even with improvement by locks or dams without interfering seriously with the Chesapeake & Ohio Railroad, which parallels it for that distance and creating a water way where transportation would be much faster and more economical by rail.

As to the river above Hinton, there is no local navigation on it on account of shoals, rapids, and falls. Between the years 1873 and 1889, the government, as I am informed, for some reason expended money in trying to make the river navigable for small boats and this was attempted but found to be entirely impracticable and was abandoned soon after its completion. I have been over this stretch of the river repeatedly in light boats and there is no evidence now remaining of the government improvement except a few notches or sluices in falls.

I further state that no freight is created between Hinton and the Virginia line which is not adequately taken care of by County Roads and trucks and by the Virginian and C & O Railroads; that there are no minerals or coal between these two points and

3304 that the mountains rise very abruptly and to a great height on each side of the river leaving a narrow gorge or valley with an occasional small bottom and that even if the river was made navigable that it would be impracticable to secure any freight from the contiguous territory on account of the conditions above stated.

I further state that there has never been any interstate commerce along the river between Virginia and West Virginia.

Given under my hand and seal this the 9th day of October 1925.

[SEAL] (Signed) C. A. TEMPLETON.

Taken, subscribed, and sworn to before me, and given under my hand and official seal this the 9th day of October 1925.

(Signed) SALLY B. SAUNDERS,
*Notary Public.*

My commission expires on the 2nd day of November 1932.

3305 *Government exhibit 100*

HEARING BEFORE FEDERAL POWER COMMISSION

In re New River Development Company Declaration of Intention. March 2, 1926. Douglas O. Morgan, Columbian Building, Washington, D. C.

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3307 New Rier (Virginia)—Federal Power Commission

Hearing relative to Declaration of Intention of the New River Development Company, affecting the New River, in Virginia.

WASHINGTON, D. C., *Tuesday, March 2, 1926.*

A hearing was held by the Federal Power Commission in the office of the Secretary of War, relative to the declaration of intention under the Federal Water Power Act filed by the New River Development Company, affecting the New River in Virginia.

Present: Hon. Dwight F. Davis, Secretary of War; Hon. Hubert Work, Secretary of the Interior; Hon. W. M. Jardine, Secretary of Agriculture; and Hon. O. C. Merrill, Executive Secretary of the Commission.

Appearances: For the New River Development Company: Walter L. Worrall, Esq.; Robert E. Scott, Esq.; C. M. Micou, Esq.; H. W. Buck, Esq. For the State of Virginia: Hon. John R. Saunders, Attorney General of Virginia; C. M. Chichester, Esq., representing State Corporation Commission of Virginia.

3308 Secretary DAVIS. Dr. Work is detained for a few minutes; but we will not keep you gentlemen waiting any longer, but will proceed.

This is a hearing on the declaration of intention of the New River Development Company.

ARGUMENT OF WALTER L. WORRALL, ESQ., ATTORNEY FOR THE NEW RIVER DEVELOPMENT COMPANY

Mr. WORRALL. Mr. Chairman and gentlemen: This is a hearing on the declaration of intention to construct a dam and water power project in the New River in Virginia.

We have made it in accordance with the provisions of the second paragraph of Section 23 of the Federal Water Power Act, which reads as follows:

"That any person, association, corporation, State, or municipality intending to construct a dam or other project works across, along, over, or in any stream or part thereof, other than those defined here-

in as navigable waters, and over which Congress has jurisdiction under its authority to regulate commerce between foreign nations and among the several States, may in their discretion file declaration of such intention with the commission, whereupon the commission shall cause immediate investigation of such proposed construction to be made, and if upon investigation it shall find that the interests of interstate or foreign commerce would be affected by such proposed construction, such person, association, corporation, State, or municipality shall not proceed with such construction until it shall have applied for and shall have received a license under the provisions of this act. If the commission shall not so find, and if no public lands or reservations are affected, permission is hereby granted to construct such dam or other project works in such stream upon compliance with State laws."

3309 Now, the Federal Water Power Act originally arose out of two bills which were before Congress, one affecting water power projects on the public lands, and the other to authorize some responsible body to give the consent of Congress to the erection of dams in navigable waters. The two were more or less joined in the act creating the Federal Power Commission. From the time when the United States originally took over jurisdiction of navigation, the regulation of navigation had been confined to the War Department.

There was confided to the Department of the Interior the public lands, and to the Department of Agriculture the forests.

Now, those were the three things that would have been affected by the development of water powers. The one principally affected here, and the only one, I think, is that in regard to navigation. In Virginia there are no Government lands and no forests reserves that I know of.

And I wish to state here that, in the jurisdiction of the Commission in non-navigable streams, it can not go beyond the Constitutional limitations imposed on Congress in regard to non-navigable streams, as construed by the decisions of the courts, that is, that the interference should not adversely affect the interests of interstate or foreign commerce.

Now, pursuant to the terms of the act, the Commission has had this matter investigated through the Department which has been charged with the jurisdiction over questions of navigation and navigable waters, that is, the War Department.

Originally, the War Department in an investigation said that they could see no reason why jurisdiction should not be taken. A re-hearing was requested on the question of the jurisdiction of the United States over non-navigable streams; and a further investigation and report was made by the Chief of Engineers of

the War Department. I should like to read that report; it is dated December 29, 1925, and is as follows:

3310 "The EXECUTIVE SECRETARY,
*Federal Power Commission, Washington, D. C.*

"DEAR SIR:

"1. Under date of October 28, 1925, you transmitted to this office a memorandum from the New River Development Company by their attorneys, Messrs. Curtis, Millet-Prevost, Colt & Mosle, in which request is made that the Chief of Engineers reconsider his report of August 20, 1925, to the Federal Power Commission on the Declaration of Intention of the New River Development Company.

"2. In that report the Chief of Engineers stated that 'while the navigable capacity of the stream is limited this office must report that no sufficient reason is seen why the Federal Power Commission should not exercise jurisdiction over the proposed project.'

"3. The declarant now requests reconsideration of those portions of this report relating to:

"A. The navigability of New River.

"B. The effect of the proposed project upon the navigable capacity of the Kanawha River.

"A careful study has been made of all the data presented by the declarant and a further study has been made of all available data and records bearing on the questions at issue which are available in this office, or which could be obtained from other government bureaus. The following report is the result of the additional studies which have been made and the additional information which has been obtained since the date of my previous report:

"A. As to the navigability of New River

"What constitutes a navigable water of the United States within the meaning of the commerce clause of the Constitution and the acts of Congress based thereon, including the Federal Power Act, has been defined in numerous decisions of the Supreme Court and from these decisions the following rule is deduced:

3310-A "'A stream is navigable in law when it is navigable in fact, and it is navigable in fact when, in its natural or improved condition, it affords a channel for useful commerce of a substantial and permanent character, conducted in the customary modes of trade and travel on water. A theoretical or potential navigability, or one that is temporary, precarious and

unprofitable, is not sufficient, but to be navigable in fact a watercourse must have practical usefulness to the public as a highway for transportation. A stream navigable in fact, as thus defined, is a navigable water of the United States when it forms by itself, or by uniting with other waters, a continuous highway over which commerce may be conducted between the States.'

"Having this rule in mind, I am of the opinion that the data and information disclosed in the Department's records and reports do not support the conclusion that New River affords a channel for useful commerce or that it is navigable in fact. That section of the river between its mouth and the town of Hinton, having a fall of about 735 feet in a distance of less than 60 miles, may be dismissed from discussion. This Department has reported that the whole section is unfavorable for navigation and that it could not be connected with navigation in the Kanawha by the expenditure of any reasonable amount.

"Surveys have been made in accordance with the direction of Congress of the stretch of river extending from Hinton, W. Va., at the mouth of Greenbrier River, upstream to the mouth of Wilson Creek in Virginia, a distance of about 190 miles. The lower 24 miles only of this stretch is in West Virginia, the remainder being in the State of Virginia and embracing practically all of the stream in that State. Survey of 128 miles, from Greenbrier River to the "Lead Mines," was made in 1872, and of the 62 miles from "Lead Mines" to Wilson Creek, in 1878, the results being printed in the annual reports of the Chief of Engineers, for 1873, pages 842 et seq., and 1879, pages 538 et seq. These surveys are very detailed, covering the river mile by mile throughout the 190 mile stretch, and the reports thereon afford the only reliable information on record of original conditions. From the survey report of 1872 on the 128-mile section below "Lead Mines," the following is quoted:

"'The river in its present condition presents the usual features of mountain streams, reaches of comparatively still and
3310–B deep water separated by rapids and shoals. In the upper portion of 35 or 40 miles the pools are generally very short, whole miles being composed of ledges of slate or limestone, 200 or 300 feet apart, with small pools between. In the lower portion, though the rapids are more concentrated, yet even then the pools will hardly average more than one mile in length. The total fall from Lead Mines to Greenbrier is 531 feet, or about 4¼ feet per mile.'

"The survey report of 1879, on the 62-mile section above Lead Mines, contains the following:

"'As is usual with mountain streams, this river presents pools of comparatively deep and still water, separated by rapids, shoals and falls. The water flows in the pools at about the rate of 1 mile per hour; over the rapids at the rate of 3 miles per hour, and over the falls at about the rate of 5 miles per hour. The depth usually over the falls is from 9 to 12 inches; frequently however, obstructions are formed below by bowlders, which increased this depth to 2 feet. Throughout this survey the pools are very short, whole miles being composed of ledges of gray and blue granite or slate, a few hundred feet apart, with very short pools between. Only five pools of a mile in length in this portion of the river. The total fall in the river from the mouth of Wilson to the Lead Mines is 507 feet, or about 8½ per mile.'

"The detailed, mile by mile, data given in the reports fully justify these concrete statements, and it seems unquestionable that the river was not navigable in fact in its original natural condition.

"It is my opinion that these natural conditions were not changed by subsequent improvements, to the extent of making the river a highway for commerce.

"It appears from the annual reports of the Chief of Engineers that the work of improvement accomplished up to the time it was finally discontinued is as follows:

"'1. From Hinton Landing to Wiley's Falls, a distance
3310–C of 26 miles, a channel 50 feet wide and 2 feet deep was obtained, practically all of which is in West Virginia, less than 2 miles extending into Virginia. The fall in this distance is 104 feet. From Wiley's shoals to New River Bridge, a distance of about 60 miles, a succession of falls, shoals and rapids, no improvement work was undertaken.

"'2. Above New River Bridge and between that point and the Lead Mines, 29½ miles of channel was deepened to 2 feet, 12 miles of which was widened to 30 feet, 2½ miles to 20 feet, and 15 miles to 10 feet. On account of the existence of Fosters Falls, the fall being 18 feet in less than half a mile, improvement work was carried no farther on this stretch.

"'3. Above Lead Mines, on a reach of 62 miles, about 5 miles of channel was improved to a depth of 2 feet and width of 20 feet.'

"Of the 190 miles of river embraced in the adopted projects, work was carried on only on about 60 miles, and this 60 miles was divided into 3 widely separated stretches with long unnavigable reaches between them. Work was limited to the most easily improved places and effort made to so ameliorate conditions as to permit local navigation. The results were not satisfactory or important and Congress discontinued appropriations

after 1886, less than one-third of the funds required for any effective improvement having been provided. In 1899, the Chief of Engineers dropped the work from his annual report, and in the river and harbor act of 1902, Congress repealed all previous provisions of law providing for the prosecution of work on the river and directed the return to the Treasury of the unexpended balance of funds pertaining thereto. The river was not thereafter considered an authorized project for improvement.

"It is evident that the work executed by the Government during the years 1877–1882, did not materially change the natural non-navigable conditions of the river. The improvement effected was at most slight and fragmentary, and the small channels worked over are reported to have deteriorated due to the natural action of ice and the current. Continuous navigation on the river has never been possible, and whatever com-
3310–D merce has existed has been *has been* altogether local apparently confined to the 25-mile section in West Virginia ending at Hinton.

"The District and Division Engineers have reported that there is no commerce and that the river is not now navigable in fact, but they assume that it is legally navigable for the reason that money has been expended on it for channel improvement by authority of Congress. It is well settled by judicial decisions that acts of Congress appropriating money for the improvement of a stream are not to be construed as declarations express or implied that the stream is actually navigable. Congress may authorize the improvement of a non-navigable stream with a view to creating navigability, yet unless the improvement is accomplished the natural state of the stream is not changed. Whether or not it is navigable is still a question of fact unaffected by the consideration that money has been appropriated and expended in an effort to improve it.

"I, therefore, conclude that New River is not at the present time a navigable water of the United States within the meaning of the Constitution and laws of Congress including section 3 of the Federal Power Act.

"B. As to the effect of the proposed project upon the navigable capacity of the Kanawha River.

"The site of the proposed dam is 155 miles above the head of navigation on the Kanawha River. The New River between this site and the Kanawha River is a series of pools of comparatively still and deep water separated by rapids and shoals. There is no known method of computing with any degree of accuracy the effect of fluctuations in flow at the dam on the stage of the river at vari-

ous distances below the dam. The pools would act as a series of storage reservoirs, the effect of which would be to equalize the flow. I am of the opinion that any periodic fluctuations in flow due to normal operation of the project works would be so attenuated by the time they had reached the Kanawha 155 miles distant as to preclude the probability of any adverse effect upon navigation on that river.

"It may be assumed as a possibility that the plant might be closed down completely for an indefinite period of time during a dry season and at a time when the storage above the dam had been drawn down. In the event of such a combination of circumstances all water from the drainage area above the dam would be shut off until the reservoir filled or until operations were resumed.

3310-E "The drainage area above Dam No. 2, the upper dam in the Kanawha River, is 8,470 square miles. The drainage area above the site of the proposed dam is 2,396 square miles. The drainage area between the proposed dam and Dam No. 2 is therefore 6,074 square miles. Records of the measured flow for the years 1909–1916 are available for streams which drain a total of 3,714 square miles of this intermediate area. From these records the total flow of the drainage area below the proposed dam has been computed for each month of the ...s for which records are available. It is found from these computations that the run-off from this drainage area below the proposed dam is sufficient to supply the necessary water for navigation on the Kanawha River under the existing project.

"Therefore, so far as can be predicted from available data and records it would not be possible to operate the proposed project so as to adversely affect navigation on the Kanawha River under the existing project.

"I, therefore, report that in my opinion New River in its present condition is not a navigable stream and that navigation on the Kanawha River will not be adversely affected by the proposed power development.

"Very respectfully,

"(Signed) H. Taylor,
"*Major General, Chief of Engineers.*"

Now that is the report of General Taylor, Chief of Engineers of the War Department, on an investigation made by him for this Commission. The War Department is the proper authority to report on this matter. The Federal Water Power Act provides that the work of the Commission shall be performed "by and through the Departments of War, Interior and Agriculture, and their engineering, technical, clerical, and other personnel, except as may be otherwise provided by law.

3311 And in the first report of the Commission it is said:

"The Commission has no field force, assigned or otherwise, but is required to depend exclusively on the field forces of the three departments for making examinations of the projects applied for; for preparing the reports upon which the Commission bases its action; and for supervising the performance by licensees and permittees of the conditions of licenses and permits issued."

You have therefore a report by the Department charged with the investigation for the Commission in which it is stated, first, that the New River is not a navigable stream; and second, that the proposed project would not affect navigation in the Kanawha River, which is the head of navigation, or where navigation starts in that system of water courses.

Under the present legislation, the Act of 1899, in the event that this dam was erected, the only authority under the statute who could determine whether that dam was an interference with interstate commerce or navigation would be the War Department; and any injunction brought by the Attorney General would be on reports furnished to him by the War Department; and it seems to me that, under this report of the Chief of Engineers of the War Department, as far as the War Department is concerned, it says that this project would not interfere with any jurisdiction which the United States has in the waters of New River; that being a non-navigable stream.

Now, the effect of not following that would be to disregard the reports of the Commission's own engineers, acting in connection with navigation.

In this connection, the report of the Chief of Engineers has been borne out by the studies of the engineers of the declarant. Some of them are here now, in the event you want any corroboration of the report of the Chief of Engineers.

3312 I wish to say further that the reason for the company filing this declaration was not that it believed that any time it was subject to the jurisdiction of the Federal Power Commission; but so much talk has been going on as to the Federal Power Commission that it had to do something one way or the other for the sale of its bonds; if it made the application and the Commission did not find that it affected navigation, or interstate or foreign commerce, it would then be in a position to say that it had been to the Federal Power Commission. In selling bonds, we have to sell other people's money. We did this out of an excess of caution, and not from any thought that the development of this project would be subject to the jurisdiction of the Commission.

The company has acquired rights in the land. It owns the damsite. It owns the power house site. It is a corporation or-

ganized and transacting a public utility business in Virginia, and as such has the right of eminent domain; and it has acquired vested rights in there, which, if it were required to take a license, it would be deprived of to a certain extent; because the terms of the license under the act are such that the Supreme Court has held in certain cases that they are not proper methods in determining valuations under the exercise of the right of eminent domain.

In the second annual report of the Commission as to its policy, I would like to call your attention to this extract:

"The question of navigability is not one of mathematical formulas, and there is no more probability that it can be removed from the domain of individual judgment than that our laws in general can be drawn with such precision that the services of the courts in their interpretation can be dispensed with. The decisions of the commission in the individual cases presented to it will establish precedents which will gradually clear the situation. Three recent cases on interstate streams, the Saco River, running from New Hampshire into Maine, the Connecticut, a boundary between New Hampshire and Vermont, and the Menominee, a boundary between Wisconsin and Michigan, are indicative
3313 of the policy the commission is pursuing.

"The first two are actually carrying property in interstate commerce in considerable quantities in the form of logs and pulp wood, and the third is suitable for such use. All three are, therefore, technically navigable; but due to the fact that in each instance the laws of the State afford full protection to such commerce, and that the proposed dams would not obstruct it, the commission made formal finding that the streams were not 'navigable waters' within the definition of the act, that the proposed dams would not affect the interests of interstate commerce, and that, therefore, no Federal license was required for their construction. The commission does not propose to extend its jurisdiction in this respect beyond the point where some substantial interest of interstate or foreign commerce is involved."

Now, that I take to be a declaration of the policy of the Commission; and as applied to this case, to this declaration, as shown by the report of the Chief of Engineers, not only is there no substantial interference with the interests of interstate or foreign commerce, but under his report there is no interference whatever.

Now, we feel in this matter that, if there is any other evidence which the Commission might have, we are entitled to meet that evidence. Unless the Commission so requires, we do not see the present necessity of having further evidence submitted by our engineers, which would only be in substantiation of the report of the Chief of Engineers of the War Department, on which, ordinarily, the Commission would act.

The State of Virginia is interested in this proposition, as it has certain rights in the waters of its own State. The Attorney General of Virginia has filed a protest in this particular instance against any declaration that this project is subject to the Federal Power Commission, and is filing a brief, and would like to be heard on the matter.

I will introduce Attorney General Saunders.

3314 ARGUMENT OF ROBERT E. SCOTT, ESQ., RICHMOND, VA., ATTORNEY FOR NEW RIVER DEVELOPMENT COMPANY

Mr. SCOTT. Mr. Chairman and gentlemen: As one of counsel for the New River Development Company, before the Attorney General of Virginia arises, I pray your indulgence while I add just a word or two to what has been so clearly and well said by my associate, Mr. Worrall.

In the first place, I would like to call your attention to a decision of the Supreme Court of the United States on this subject which, as I read the act, is the foundation of the section under which we are proceeding.

I refer to the case of Kansas v. Rio Grande Dam and Irrigation Company, 174 U. S. 690, decided in 1899.

As you are not lawyers, it may be well for me to tell you what that case was. In that case the Rio Grande Dam and Irrigation Company proposed to build a dam across the Colorado River for the purpose of diverting the waters of that stream entirely to irrigation.

The United States, through its proper officers, intervened and filed a bill to enjoin the construction of the dam, on the ground that the navigable capacity of the Rio Grande River (the Colorado being a tributary of that river) would be impaired. The court below held that, inasmuch as the Colorado River was a non-navigable stream, the Federal Government had no right to interfere.

Upon appeal to the United States Supreme Court, that court held that the Federal Government, as the guardian of the navigable capacity of its navigable waters, had a right to inquire as to whether or not the proposed project would interfere with the navigable capacity of the stream below. It therefore reversed the action of the lower court, and remanded the case to that court, for the inquiry as to whether or not the navigable capacity of the Rio Grande River would be affected by the construction of the proposed dam.

3315 In doing that, the court used this language—and as I will point out to you in a moment, the act here is practically a transcript of what the court there said:

"The case is remanded with instructions to set aside the decree of dismissal"—

which was the act of the lower court,

"and to order an inquiry into the question whether the intended acts of the defendants in the construction of the dam, and in appropriating the waters of the Rio Grande will substantially diminish the navigability of that stream, within the limits of present navigability, and if so, to enter a decree restraining those acts to the extent that they will so diminish it."

Conversely, the proposition was also true that, if the answer was in the negative, the bill would be dismissed. In the course of its opinion on the subject, the court said that, of course, when such proceedings are instituted it becomes a question of fact whether the act sought to be enjoined is one which fairly and directly tends to obstruct the navigability of a stream.

You will see at once the point that I am approaching. Now, when you come to examine the section under which we are proceeding, which is the last paragraph of section 23 of the Federal Water Power Act, you will find the thought there, and the principle there embodied.

It says that, wherever a corporation proposes to erect a dam in a stream such as the New River, about which there may be some question about the effect on navigability, it shall file a declaration of intention with the Commission. Now, mark the duty of the Commission. It is so clear that the wayfaring man may easily read it:

"whereupon the commission shall cause immediate investigation of such proposed construction to be made, and if upon investigation it shall find that the interests of interstate or
3316 foreign commerce would be affected by such proposed construction, such person, association, corporation, State, or municipality shall not proceed with such construction until it shall have applied for and shall have received a license under the provisions of this act. If the commission shall not so find, and if no public lands or reservations are affected, permission is hereby granted to construct such dam or other project works in such stream upon compliance with State laws."

Under that section, we have proceeded; and we come to this Commission for the answer to that question.

The question is a narrow one. It lies within exceedingly narrow limits. We ask this Commission to determine it, in order that we may market out bonds, without the shadow of a cloud upon our authority to erect this dam. We are here to clear the cloud as it may be, upon our rights to erect this dam and to

market our securities; and we come and ask the Commission for the answer to that question.

We do not come, if your Honors please, without an invitation. I find in your second annual report that this question has heretofore been considered by this Commission. It was upon this invitation, largely, that I came and advised the institution of this proceeding.

The Commission said in that report, as Mr. Worrall has read to you, that the question of navigability is not one of easy determination; but that in each case the Commission will consider it upon its merits; and if there is no public need, no public requirement, for the exercise of its powers, it will refrain from exercising them.

The Commission cited three cases, which are referred to on page 3 of that report; and it said—and I ask you to mark what this Commission has said in that report:

"The decisions of the commission in the individual cases presented to it will establish precedents which will gradually clear the situation. Three recent cases on interstate streams, the Saco
River, running from New Hampshire into Maine, the
3317 Connecticut, a boundary between New Hampshire and
Vermont, and the Menominee, a boundary between Wisconsin and Michigan, are indicative of the policy the commission is pursuing."

And I refer to the precedents there for my appearance here, if any precedent be needed.

Continuing, the report said:

"The first two are actually carrying property in interstate commerce in considerable quantities in the form of logs and pulp wood, and the third is suitable for such use. All three are, therefore, technically navigable; but due to the fact that in each instance the laws of the State afford full protection to such commerce, and that the proposed dams would not obstruct it."

Now, mark this language, if you please—

"the commission made formal finding that the streams were not 'navigable waters' within the definition of the act, that the proposed dams would not affect the interests of interstate commerce, and that, therefore, no Federal license was required for their construction."

Now, I ask you again to mark the ground; because, said the Commission—

"The proposed dam would not affect the interests of interstate commerce, and therefore, no Federal license was required for their construction."

I came too, because I felt, if the Commission please, that I was not before a hostile tribunal, avaricious of power and stretching out its hands for jurisdiction where there was no substantial foundation for it; because I find that that paragraph which I have just been reading closed with these words:

"The commission does not propose to extend its jurisdic-
3318 tion in this respect beyond the point where some substantial interest of interstate or foreign commerce is involved."

Let me read that to you again: because it is an answer to any criticism that there may be, or as to any inquiry as to why I am here and why I confidently look to this Commission for a negative answer to the single question which I have propounded to it:

"The commission does not propose to extend its jurisdiction in this respect beyond the point where some substantial interest of interstate or foreign commerce is involved."

I find in this same book, at page 117, that this Commission has acted heretofore on that theory. There it is said:

"In the matter of the declaration of intention of the Caddo River Power & Irrigation Co., of Little Rock, Ark., to construct two dams across and in Caddo Creek, a branch of Ouachita River, in Clark County, Ark., the Commission having caused the matter to be investigated and it appearing from the report of such investigation that Caddo Creek is not a navigable water of the United States and that the proposed construction will not affect interstate or foreign commerce, it was noted that the Commission finds that the interests of interstate or foreign commerce would not be affected by such proposed construction."

And that is all that we ask to be done in this proceeding. Now, let us come for a moment—and I shall not detain you long—to the merits of the proposition:

This declaration of intention, you will find when you come to examine it, was filed some months ago—last June, thereupon, a careful, painstaking and exhaustive examination of the subject was made, with a view of ascertaining definitely whether the interests of interstate or foreign commerce would be affected: It was not done haphazard. It was not done by unauthorized people.

If you will turn to the act to which I have had reference, you will find that there is a provision in section 2 of the act to
3319 which I ask your particular attention:

"The work of the commission"—

That is you gentlemen—

"shall be performed by and through the Departments of War, Interior and Agriculture and their engineering, technical, clerical, and other personnel, except as may be otherwise provided by law."

Investigation of this matter is to be performed by and through the Department of War. The report of that investigation—and they made a most careful, thorough, exhaustive and painstaking one—is before you.

And bearing in mind, now, that the one question to be answered is, as you answered it in the Caddo Case, whether the interests of interstate or foreign commerce would be affected by this, we find that it has been directly answered in terms too clear to admit of doubt—and not by any unauthorized person; but by the agency appointed to do it by the statute—the War Department; and by the report of the Chief of Engineers of that Department, after investigation by men highly skilled in their duties; men whose opinions this Commission must rely upon; men whose report, I submit, this Commission must follow.

And they say two things which are conclusive of the proposition now before the Commission. They said that they had careful and exhaustive computations in reference to the matter, with this result:

"It is found from these computations that the runoff from this drainage area below the proposed dam is sufficient to supply the necessary water for navigation in the Kanawha River under the existing projects."

Having first said before that that the New River at this point was a non-navigable stream, the only question left open was whether or not the interests of interstate or foreign commerce would be affected by this dam.

Their first promise is that the run-off from the main area below the dam is sufficient to supply the necessary water for navigation on the Kanawha River under the existing contract.

3320 One other question that naturally suggested itself was: Could the existing project, if carried to completion, be so operated as to be detrimental to navigation of the stream below? And mark the answer:

"Therefore, so far as can be treated from available data and records, it would not be possible to operate the proposed project so as to adversely affect navigation on the Kanawha River under the existing project."

May I take the liberty of just calling your attention to that finding?

Therefore, says Gen. Taylor, Chief of Engineers—a Major General of the United States Army—therefore, so far as can be predicted from available data and records, it would not be possible to operate the proposed project so as to adversely affect navigation on the Kanawha River under the existing project.

May I submit, then, that the matter must necessarily be concluded, unless there be some countervailing evidence, of which I

have heard none? If there be anybody to question that finding, we would like to hear him.

We ask the right at the hands of this Commission to be present when the testimony shall be produced and to be allowed to cross examine the witnesses and to introduce countervailing evidence.

I have here, if the Commission please, some of the most distinguished hydraulic engineers of my acquaintance—men who have made a study of this thing for years. I myself have been operating on this stream for years, since 1912. I come from the State of Virginia, and I know whereof I speak. And I am prepared to say to the Commission, upon my own responsibility, that those findings of Gen. Taylor are true, and they will stand the test, without the fear of successful contradiction.

Coming back, then, to my original proposition, if the Commission please, that is as to your duty under the act; I have read the act to you, which says that you shall answer the question, and the question alone, whether or not the proposed project
3321 will affect the navigable capacity of the stream below.

And I submit, without the fear of successful contradiction, that that answer must be in the negative; and I ask for that answer at your hands.

If the Commission please, there is one other aspect of this case which is in the hands of others.

This dam is proposed to be built in the State of Virginia by one of its public service corporations—a corporation which serves the most important industrial area in that State; and when the Governor of Virginia heard, or was advised of this pending application, he did two things: He called in his Attorney General, and told him to investigate it, and if it should be found that the stream is not a navigable stream, to enter the protest of the State against the assumption of jurisdiction here.

There is another branch of the State Government which has supervision over these matters, and that is the State Corporation Commission. It is a regulatory body, charged by law with the regulation of public utilities and public service corporations of the State. Its duties are to supervise the acts and practices, the rates and the conduct of those companies. And that body has sent its attorney here to make known its wishes or its views of the situation.

I shall therefore ask the privilege, if the Commission please, of presenting to this body, Hon. John R. Saunders, Attorney General of Virginia, who will present the protest of the State in this matter, together with a brief statement of the reasons underlying that protest.

ARGUMENT OF HON. JOHN R. SAUNDERS, ATTORNEY GENERAL OF VIRGINIA

Mr. SAUNDERS. If the Commission please: I hold in my hand some copies of the brief which was filed on behalf of the State of Virginia, and also on behalf of the State Corporation Commission.

3322 In making this appearance on behalf of the State, I also desire to file this paper, which I will read:

"Before the Federal Power Commission. In Re New River Development. Declaration of Intention Project # ———.

"The State of Virginia by its Attorney General, by direction of the Governor thereof, hereby makes known to the Commission that it protests against the assumption of jurisdiction by it of the project above referred to.

"The grounds upon which this protest is based are set out in part in a brief herewith filed.

"(Signed) JNO. R. SAUNDERS,
"*Attorney General of Virginia.*"

Now, if the Commission please, I shall be very brief in the statement which I am going to make to the Commission, due to the fact that the reasons why the state of Virginia is protesting against the assumption of power on the part of the Federal Power Commission have been fully set forth in the brief which has been filed.

We believe, if the Commission please, that those reasons which we have assigned are fully substantiated and maintained by the decisions of the United States Supreme Court.

As this Commission doubtless knows, Virginia, unlike many other States in this Union, has still maintained and reserved to itself, for the benefit of all citizens of that Commonwealth, the beds and shoals of the rivers and streams which go through that State. She has done that for reasons which were best known to herself; and it has been a source of gratification to her citizens, and in many instances, it is a source of revenue, particularly in the Eastern section of the State, where I am from, where the oysters and the fish are mainly produced to supply surrounding territory.

This great Government of ours, as you all know, is formed of two great systems, dual in its capacity—the Federal and the State Governments.

3323 For more than a century and a half, or nearly a century and a half, as has been said by one of the learned judges of the Supreme Court, that that has endured, our country has prospered and things have moved on smoothly.

Virginia is very proud of the part which she played in the framing and making of this great constitution, the Federal Con-

stitution, for which she has great respect, and which our citizens cling to as a Magna Charta of our civilization. If I mistake not, history records the fact that it was hung in the balance, eight states having ratified it, and North Caroline and Rhode Island having voted against it. The Convention waited with breathless suspense on that occasion to see what Virginia would do—she was the largest State in the Union—and what her attitude would be. It was then that Mr. Madison, who is familiarly known to all citizens as the Father of The Constitution, took his stand and took his position in that great Convention, and Virginia voted for ratification and the Constitution was preserved and saved.

And yet with all of the admiration which she holds for that Constitution, and with all the obeisance which she pays to the Federal Government and the Bureaus thereof, Virginia still maintains that there are certain inalienable rights which are guaranteed to her by that Constitution, and to the citizens of Virginia by her own constitution; and we believe that the Federal Government has no right to usurp certain powers over which the State exercises its control.

The Tenth Amendment to the Constitution says that powers not delegated to the United States by the Constitution, nor prohibited by it to the States are reserved to the States, respectively, or to the people.

The power of the Federal Government in navigable waters is limited to the regulation of navigation in interstate or foreign commerce.

Second, navigation is only one of the uses of which navigable waters are suspectible.

And third, in all other respects, internal or riparian
3324 waters are fully reserved to State control, as in the regulation of fisheries, in the control of the shores, and the ownership of submerged lands.

Mr. Chief Justice Taft, in delivering the opinion in the Child Labor Tax Case, used this language:

"It is the high duty and function of this court in cases regularly brought to its bar to decline to recognize or enforce seeming laws of Congress, dealing with subjects not entrusted to Congress, but left or committed by the supreme law of the land to the control of the States. We cannot avoid the duty, even though it require us to refuse to give effect to legislation designed to promote the highest good. The good sought in unconstitutional legislation is an insidious feature because it leads citizens and legislators of good purpose to promote it without thought of the serious breach it will make in the ark of our covenant or the harm which will come from breaking down recog-

nized standards. In the maintenance of local self-government, on the one hand, and the national power, on the other, our country has been able to endure and prosper for near a century and a half."

Now, if the Commission please, the question which confronts this Commission today is, first, Is the New River a navigable stream? If it is not a navigable stream; if the rights of the Federal Government, so far as interstate or foreign commerce are concerned are not impeded, are not hindered, are not infringed upon, by the construction of this dam; then, if the Commission please, it becomes a matter for the State of Virginia to control as to how, under what conditions, and the manner in which this dam shall be constructed by one of its citizens.

As has been said by the gentlemen who have preceded me, Gen. Taylor has been delegated as the authority to make an investigation in this matter. He has reported in the negative, namely, that this river is not a navigable stream.

And the report goes further: That under no circumstances could the erection of this dam which is in contemplation
3325 by the New River Development Company in any manner interfere with the navigability of the Kanawha River, into which the New River flows.

Now, with that statement of facts before the Commission; and with the decisions of the courts based upon this dual form of Government, to which I have briefly referred, I cannot for a moment think but what this Commission will say that, having investigated the matter, it now becomes a matter for the State of Virginia to control the erection of this dam.

May I read the closing paragraph of this brief?

"This Commonwealth has in the past suffered no usurpation of its power, nor violation of property rights of its citizens protected by its laws, nor will such action be suffered in the future."

I trust the Commission will not construe that language to mean anything like a threat to this body; but simply that Virginia, believing that she has certain inherent powers which are guaranteed to her by the Federal Constitution, and which she has always sought to maintain and to preserve, through local self-government and by the provisions of her own constitution—believing that, we come in this manner and file our protest against the jurisdiction of the Commission, and say to the Commission that, having investigated the matter, the facts having been presented to the Commission, there can be but one answer, as was said by Mr. Scott.

Thank you, gentlemen.

Secretary Davis. Does that conclude the hearing?

Mr. SCOTT. Mr. Chairman, I would like to raise a point of inquiry as to your procedure.

The question before the Commission, as I have indicated, as I understand it, is one of fact. The fact has been investigated and reported upon by the Chief of Engineers of the Army, the officer of the Government intrusted with this inquiry.

I want to ask if the Commission wants to hear testimony in support of that report, or whether it will hear testimony
3326 against it, so that we know how to proceed?

Secretary DAVIS. Have you any briefs which you could file?

Mr. SCOTT. We have filed briefs.

Secretary DAVIS. I mean on the other feature?

Mr. SCOTT. On the facts?

Secretary DAVIS. Yes.

Mr. SCOTT. We have recited the report of the Army officer having that duty, and if that report is to be questioned, we would like to be heard on that.

Secretary DAVIS. I do not think that will be necessary.

Secretary WORK. Is there anybody here to speak on the other side?

Secretary DAVIS. Yes; we would like to know if there is anybody here to speak on the other side.

Mr. SCOTT. I have not heard of anybody.

I would like to present to the Commission, at this stage, Mr. C. M. Chichester, of the office of the State Corporation Commission of Virginia, who desires to say a few words.

STATEMENT OF MR. C. M. CHICHESTER, REPRESENTING STATE CORPORATION COMMISSION OF VIRGINIA, RICHMOND, VIRGINIA

Mr. CHICHESTER. May it please the Commission: I appear for the Corporation Commission of Virginia; and I concur with the Attorney General of Virginia in filing the brief and in presenting the protest to the taking of jurisdiction by the Federal Power Commission in this case.

The Corporation Commission in Virginia is that department of the government which has charge of public utilities; and we feel, upon the assumption that the report of the Chief of Engineers is correct, that this stream is not navigable; and that the project will not injuriously affect navigation on an interstate stream, that we are amply able to exercise such supervision as may be necessary in the performance of its public functions.

3327 I desire to file with the Commission the protest of the State Corporation Commission.

Secretary WORK. You are the agent of the Governor of the State, are you?

Mr. CHICHESTER. I am the counsel of the State Corporation Commission.

Secretary DAVIS. And they have filed that statement of protest?

Mr. CHICHESTER. Yes.

(The statement referred to is as follows):

"Before the Federal Power Commission. In re New River Development Company. Declaration of Intention.

"STATEMENT BY THE STATE CORPORATION COMMISSION OF VIRGINIA

"The State Corporation Commission of Virginia, comes as amicus curiae, and not as a party to the proceedings, and prays leave as such to present its views in this matter to the Federal Power Commission, and to that end files herewith a brief, signed by its counsel on its behalf, in cooperation with the Attorney General of Virginia.

"It is therefore respectfully asked that the brief hereby and herewith tendered be received and considered by the Federal Power Commission as a brief filed by the State Corporation Commission of Virginia amicus curiae.

"STATE CORPORATION COMMISSION OF VIRGINIA,
"By BERKLEY D. ADAMS, *Chairman.*
"LESTER HOCKER, *Commr.*
"LOUIS S. EPES, *Commr.*"

3328 Mr. SCOTT. If this Commission does not desire to hear any evidence—and I imagine not—that is all we have to say.

Secretary DAVIS. I thank you very much, gentlemen; and we will give the matter consideration.

(Thereupon at 4:50 o'clock p. m., the Commission was adjourned.)

3329 *Government exhibit No. 101*

1926, Oct. 28; Sept. 28; Nov. 20—re: Application for license. Notice of public hearing at Radford Sept. 28, 1926. Mailing list of notices Sept. 28, 1926. Transcript of public hearing at Radford, Oct. 28, 1926. Statement filed on behalf of Appalachian Electric Power Co. regarding protests, Nov. 20, 1926.

3330 WAR DEPARTMENT,
U. S. Engineer Office,
*Huntington, W. Va., September 28, 1926.*

NOTICE OF PUBLIC HEARING

The application of The Appalachian Electric Power Co. of Richmond, Va., for license to construct a water power develop-

ment and dam across New River at a point approximately one mile above the mouth of Little River and seven miles above the city of Radford, Virginia, will be considered at a public hearing on the subject, to be held by the undersigned at the city of Radford, Virginia, in the corporation court room at 1:00 p. m. October 28, 1926.

All interested parties are invited to be present or to be represented at the above time and place, particularly navigation interests and the officials of any county, city, town or local association, whose interests may be affected by the construction of the proposed work. They will be given an opportunity to express their views upon the suitability of the location and the adequacy of the plans in reference to navigation, and to suggest changes considered desirable in the interest if navigation.

Oral statements will be heard, but for accuracy of record all important facts and arguments should be submitted in writing, as the records of the hearing will be forwarded for consideration of the War Department. Written statements may be handed to the undersigned at the hearing or mailed to him beforehand.

The plans submitted by the applicants show a dam 110 feet high across New River, also a powerhouse adjacent to and below the south end of the dam. They propose to install four or possibly five—20,000 horsepower turbines and electric generating equipment. The reservoir created would be approximately 19 miles long and cover an area of approximately 4,000 acres.

A map showing the proposed project may be examined by those interested at:

U. S. Engineer Office, 13th floor Coal Exchange Bldg., Huntington, W. Va.

U. S. Engineer Office, 3d floor Post Office Bldg., Charleston, W. Va.

U. S. Post Office, Radford, Virginia.

H. M. TRIPPE,
*Major, Corps of Engineers,*
*District Engineer.*

3331 U. S. ENGINEER OFFICE,
*Huntington, W. Va., September 28, 1926.*

Mailing list for Notice of Public Hearing at Radford, Va., on October 28th, on application of the Appalachian Electric Power Co., for license to construct a waterpower project on the New River near Radford, Va.

Copy sent to the following: Chamber of Commerce, Charleston, W. Va.; Chamber of Commerce, Huntington, W. Va.; Chamber of Commerce, Bluefield, W. Va.; Chamber of Commerce, Roanoke, Va.; Governor of the Commonwealth of Virginia (2 copies), Richmond, Va.; Governor of the State of North Carolina (2 copies), Raleigh, N. C.; Governor of the State of West Virginia (2 copies), Charleston, W. Va.; The State Corporation Commission, Richmond, Va.; The Public Service Commission of W. Va., Charleston, W. Va.; Mr. C. M. Chichester, Counsel for State of Va., Richmond, Va.; Mr. W. P. Wiltsee, Chief Engineer, Norfolk & Western Railway Co., Roanoke, Va.; Mr. H. Fernstrom, Chief Engineer, Virginian Railway Co., Norfolk, Va.; Mr. C. W. Johns, Chief Engineer, Chesapeake & Ohio Railway Co., Richmond, Va.; Norfolk & Western Railway Co., Bluefield, W. Va.; Appalachian Electric Power Co., 30 Church St., New York City; Appalachian Electric Power Co., Bluefield, W. Va.; Appalachian Electric Power Co., Richmond, Va.; Mr. Geo. M. Tidd, App. Elec. Pow. Co., 30 Church St., New York City; Mr. N. M. Argabrite, App. Elec. Pow. Co., 30 Church St., New York City; Mr. R. E. Breed, App. Elec. Pow. Co., 30 Church St., New York City; Mr. H. S. Reynolds, App. Elec. Pow. Co., 30 Church St., New York City; Viele, Blackwell and Buck, 49 Wall Street, New York City; Messrs. Curtis, Mallet-Prevost, Colt & Mosle, 30 Broad St., New York City; Mr. H. S. Slocum, Box 33, Bluefield, W. Va.; Mr. B. C. Ward, Byllesby, Va.; Mr F. W. Scheidenhelm, 50 Church Street, New York City; The West Virginia Power Co., Charleston, W. Va.; Mr. L. H. Davis, Room 2021 Carbide & Carbon Bldg., 30 East 42nd St., New York City; Mr. Geo. T. Lancaster, Supt. Electro-Metallurgical Co., Glen Ferris, W. Va.; The Central Power Company, 1132 Munsey Bldg., Washington, D. C.; Mr. J. E. S. Thorpe, 2312 California Street, Washington, D. C.; The Aluminum Company of America, Oliver Bldg., Pittsburgh, Pa.; Mr. G. B. Bebout, Eastern States Dev. Co., Box 437, Zanesville, Ohio; Mr. O. L. Stearnes, Salem, Va.; Mr. H. W. Markle, Appalachian Electric Power Co., Bluefield, W. Va.; Board of Supervisors, Pulaski County, Pulaski, Va.; Board of Supervisors, Giles County, Pearisburg, Va.; Board of Supervisors, Fayette County, Fayetteville, W. Va.; Board of Supervisors, Summers County, Hinton, W. Va.; Mr. A. W. Giles, Virginia Geological Survey, Charlottesville, Va.; Mr. E. D. Burchard, U. S. Geological Survey, Asheville, N. C.; Mr. A. H. Horton, U. S. Geological Survey, Washington, D. C.; Virginia Water Power & Development Commission, Richmond, Va.; The Ludlow Engineers, Winston Salem, N. C.; Mr. W. O. Borcherdt, Supt. Bertha Mineral Co., Austinville, Va.; Mr. Jas. S. Browning,

3332 Pocahontas, Va.; Mr. W. A. Williams, Pearisburg Va.; Mr. W. H. Kersey, Bluefield, W. Va.; Mr. R. W. Arthur, City Manager, Radford, Va. (3 copies); Mr. A. H. Chembley, Belspring, Pulaski County, Va.; Mr. A. H. Hearn, Bluefield, W. Va.; Secretary American Society of Civil Engineers, 33 W. 39th St., New York City; Chief of Engineers, U. S. Army, (6 copies with letter); Federal Power Commission, (6 copies with letter); The Division Engineer, 413 Customhouse, Cincinnati, Ohio (with letter); Postoffice, (with letter) Radford, Va.; U. S. Engineer Office, Charleston, W. Va.; S. L. Tone, 5305 Westminster St., Pittsburgh, Pa.

NOTE.—Newspapers and periodicals furnished copies of notice are listed on separate sheet, attached to copy of circular letter to publishers.

WAR DEPARTMENT,
U. S. ENGINEER OFFICE,
*Huntington, W. Va., September 28, 1926.*

Subject: Notice of Public Hearing.
To: The Publisher.

Inclosed herewith is a copy of notice of public hearing to be held at Radford, Virginia, on October 28, 1926, on the application of the Appalachian Electric Power Co., Richmond, Virginia, for a license to construct a water power development on the New River near Radford, Virginia.

This notice is sent you with the hope that you may be able to use it as a news item. Unfortunately, no funds are available for advertisement but the subject matter is of such general public interest that it is thought you will be glad to handle it as a news item.

H. M. TRIPPE,
H. M. Trippe,
*Major, Corps of Engineers,*
*District Engineer.*

1 inclosure—Public notice.

3333 U. S. ENGINEER OFFICE,
*Huntington, W. Va., September 28, 1926.*

Mailing list for circular letter to newspaper publishers, dated September 28, 1926, requesting that the matter of a public hearing at Radford, Virginia, October 28, 1926, concerning water power license application of the Appalachian Electric Power Co. be made a news item.

Copy sent to the following: The Bluefield Telegraph, Bluefield, W. Va.; The Post-Herald, Beckley, W. Va.; The Charleston Mail, Charleston, W. Va.; The Charleston Gasette, Charleston, W. Va.; The News, Hinton, W. Va.; The Independent Herald, Hinton, W.

Va.; The Advertiser, Huntington, W. Va.; The Herald-Dispatch, Huntington, W. Va.; The Daily Register, Point Pleasant, W. Va.; The Wheeling News, Wheeling, W. Va.; The Wheeling Register, Wheeling, W. Va.; The Wheeling Intelligencer, Wheeling, W. Va.; The Fayette Tribune, Fayetteville, W. Va.; The Greenbrier Independent, Lewisburg, W. Va.; The West Virginia News, Ronceverte, W. Va.; The Evening Press, Princeton, W. Va.; The Putman Democrat, Winfield, W. Va.; The Putman Leader, Winfield, W. Va.; The Watchman, Union, W. Va.; The Manufacturers Record, Baltimore, Md.; The Grayson Sun, Independence, Grayson County, Va.; The Gazette, Alexandria, Va.; The Herald-Courier, Bristol, Va.; The Ledger Dispatch, Norfolk, Va.; The Virginian-Pilot, Norfolk, Va.; The Times-Dispatch, Richmond, Va.; The News-Leader, Richmond, Va.; The Times, Roanoke, Va.; The World News, Roanoke, Va.; The Progress and Index, Petersburg, Va.; The Southwest Times, Pulaski, Va.; The Engineering and Contracting Pub. Co., 221 E. 20th St., Chicago, Ill.; The Engineering News-Record, 10th Ave. at 36th St., New York City.

Postmasters: Pearisburg, Va. (letter)—4 copies notice, 3 copies circular; Christiansburg, Va. (letter)—4 copies notice, 3 copies circular; Wytheville, Va. (letter)—4 copies notice, 3 copies circular; Richmond, Va., Radford, Va., Roanoke, Va., Bluefield, W. Va., letter (1 copy of notice).

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Summary of proceedings at public hearing, held in the court room of the Corporation Court for the City of Radford, Virginia, on October 28th, 1926, in the matter of the application of Appalachian Electric Power Company for license under the Federal Power Act to construct a project of water power development on New River at a point one mile above the mouth of Little River and seven miles above the City of Radford, Va.

The meeting was called to order at 1:00 P. M. by Major H. M. Trippe.

3335 The following interested parties were present: H. M. Trippe, Major Corps of Engineers, U. S. Army, District Engineer, Huntington, W. Va.; H. C. Adams, Assistant Engineer, Virginian Railway Co., Norfolk, Va.; L. J. Bevan, Viele, Blackwell and Buck, Engineers Appalachian Electric Power Co., 49 Wall St., New York City; H. W. Buck, Appalachian Electric Power Co., 49 Wall St. New York City; A. H. Chumbley, Chairman Board of Supervisors, Pulaski County, Pulaski, Va.; John S. Draper, Appalachian Electric Power Co., Pulaski, Virginia; R. J. Holden, geologist, Appalachian Power Co., Blacksburg, Virginia; H. G. Hall, Attorney for Virginian Railway Co., Roanoke, Va.; C. A. Ferguson, Newport News Ship Building and Dry Dock Co., Newport News, Va.; Charles G. Harris, Engineer, Chesapeake & Potomac Telephone Co., Richmond, Va.; T. L. Einstein, East Radford, Virginia; Dr. W. P. Nye, East Radford, Virginia; H. C. Tyler, East Radford, Virginia; H. E. Sledd, Appalachian Electric Power Co., Bluefield, W. Va.; John Preston McConnell, President State Teachers College, E. Radford, Va.; W. H. Painter, Councilman, Radford, Va.; T. F. Turner, Norfolk and Western Railway Co., Roanoke, Va.; C. M. McCou, Counsel Appalachian Electric Power Co., 30 Broad St., New York City; R. W. Arthur, City Manager, Radford, Va.; Robt. E. Scott, Counsel Appalachian Electric Power Co.,

3336 Richmond, Va.; Major P. S. Reinecke, Asst. Chief Engineer, Federal Power, Washington, D. C.; Col. F. W. Scheidenhelm, Consulting Engineer for Appalachian Electric Power Co., 50 Church St., New York City; R. E. McKenzie, Assistant Engineer, U. S. Engineers Office, Huntington, W. Va.; R. S. Slocum, Appalachian Electric Power Company, Bluefield, W. Va.; L. H. Davis, Electro Metallurgical Co., 30 East 42nd St., New York City; Ben G. Smith, Electro Metallurgical Co., 30 East 42nd St., New York City; F. P. McConnell, Peoples Bank of Radford, Radford, Va.; R. J. Noell, City of Radford, East Radford, Va.

Major H. M. TRIPPE. This meeting has been called for the purpose of hearing evidence on the application made by the Appalachian Electric Power Company, Richmond, Virginia, to the

Federal Power Commission. The company has asked for a license for a project of water-power development on New River at a point approximately one mile above the mouth of Little River and seven miles above the City of Radford, Virginia. They have asked for a license allowing them one year from the date of such license to begin construction and four years for completing construction of the project works. The license, if granted, will authorize the construction, operation and maintenance of certain project works, the principal ones of which are designated as follows:

(a) Dam and reservoir.—Concrete dam, height 110 feet, across New River. Reservoir created by dam approximately 19 miles long. Surface area of reservoir approximately 4,000 acres.

(b) Water conduits.—Turbines will be connected to in-
3337 takes by stell penstocks embedded in retaining section of dam.

(c) Powerhouse.—Powerhouse will be of brick and steel construction containing 4 and possibly 5 15,000 k.w. alternating current generators.

(d) Transmission lines.—Power is to be generated at 13,200 volts, 60 cycles and is to be conducted into the transmission system already in operation located outside the project boundary, about 500 feet from the powerhouse.

It is desired to have a frank and full expression of the views of all interested parties and as complete a statement as possible of all information bearing upon the question at issue.

The Department will give full weight to all evidence and arguments presented at the hearing; and all pertinent material which the parties wish considered should be brought out at this hearing.

Later ex parte evidence and arguments are not desired by the reviewing authorities unless it is clearly shown that the matter is new and material and that there are good reasons why it could not have been presented at this hearing. Such matter will be called to the attention of opposing interests and they will be given an opportunity to reply if the decision of the Department is otherwise likely to differ from their wishes. Every interested person will be given a reasonable opportunity to be heard. If it is alleged by anyone present that important evidence exists which could be properly prepared in time for the hearing, action will be taken to give a reasonable period for its examination by the opposition and others interested. In any such case, a definite statement should be made as to the amount of time required.

The law applicable is the Federal Water Power Act approved June 10th, 1920:

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That a commis-

sion is hereby created and established, to be known as the Federal Power Commission, (hereinafter referred to as the commis-
3338 sion), which shall be composed of the Secretary of War, the Secretary of the Interior and the Secretary of Agriculture.

To issue licenses to citizens of the United States or to any corporation organized under the laws of the United States or any State thereof, or to any State or municipality for the purpose of constructing, operating, and maintaining dams, water conduits, reservoirs, power houses, transmission lines, or other project works necessary or convenient for the development and improvement of navigation, and for the development, transmission and utilization of power across, along, from or in any of the navigable waters of the United States, or upon any part of the public lands and reservations of the United States (including the Territories) or for the purpose of utilizing the surplus water or water power from any Government dam, except as herein provided: Provided, That licenses shall be issued within any reservation only after a finding by the commission that the license will not interfere or be inconsistent with the purpose for which such reservation was created or acquired, and shall be subject to and contain such conditions as the Secretary of the department under whose supervision such reservation falls shall deem necessary for the adequate protection and utilization of such reservation: Provided further, That no license affecting the navigable capacity of any navigable waters of the United States shall be issued until the plans of the dam or other structures affecting navigation have been approved by the Chief of Engineers and the Secretary of War. Whenever the contemplated improvement is, in the judgment of the commission, desirable and justified in the public interest for the purpose of improving or developing a waterway or waterways for the use or benefit of interstate or foreign commerce, a finding to that effect shall be made by the commission and shall become a part of the records of the commission: Provided, further, That in case the commission shall find that any Government dam may be advantageously used by the United States for public purposes in addition to navigation, no license therefor shall be issued until two years after it shall have reported to Congress the facts and conditions relating thereto, except that this provision shall not apply
3339 to any Government dam constructed prior to the passage of this act: and provided further, That upon the filing of any application for a license which has not been preceding by a preliminary permit under subsection (3) of this section, notice shall be given and published as required by the proviso of said subsection.

That licenses under the act shall be issued for a period not exceeding fifty years. Each such license shall be conditioned

upon acceptance by the license of all the terms and conditions of this act and such further conditions, if any, as the Commission shall prescribe in conformity with this act, which said terms and conditions and the acceptance thereof shall be expressed in said license. Licenses may be revoked only for the reasons and in the manner prescribed under the provisions of this act, and may be altered or surrendered only upon mutual agreement between the licensee and the commission after ninety days' public notice.

Each licensee hereunder shall be liable for all damages occasioned to the property of others by the construction, maintenance, or operation of the project works or of the works appurtenant or accessary thereto constructed under the license and in no event shall the United States be liable therefor.

That wherever any licensee hereunder is directly benefited by the construction work of another licensee, a permittee, or of the United States of a storage reservoir or other headwater improvement, the commission shall require as a condition of the license that the licensee so benefited shall reimburse the owner of such reservoir or other improvements for such part of the annual charges for interest, maintenance and depreciation thereon as the commission may deed equitable. The proportion of such charges to be paid by any licensee shall be determined by the commission.

That nothing herein contained shall be construed as affecting or intending to affect or in any way to interfere with the laws of the respective States relating to the control, appropriation, use, or distribution of water used in irrigation or for municipal or other uses, or any vested right acquired therein.

The following protests have been received and will be read:

Exhibit A.—Telegram from F. M. Livezey, Atty. for
3340 Public Service Commission of West Virginia.

Exhibit B.—Letter from W. P. Wiltsee, Chief Engineer, N. & W. Ry. Co.

Exhibit C.—Letter from Legal Dept. Virginian Railway Co.

Exhibit D.—Petition Electro Metallurgical Co.

Exhibit "A"

WASHINGTON, D. C., *Oct. 28, 1926.*

H. M. TRIPPE,

*Major, U. S. Engineers, Radford, Va.*

Reference application Appalachian Electric Power Company for license for dam near Radford. The Public Service Commis-

sion of West Virginia objects to granting of license unless ample protection is made for present and future development of water power in West Virginia. Stop. Date of hearing called to my attention only yesterday. Impossible to attend because of engagement here. Stop. Further time is requested in which to present more formally the States position.

(Signed) F. M. LAVELEY,
*Atty. for the Public Service Commission of West Virginia.*

Exhibit "B"

NORFOLK AND WESTERN RAILWAY CO.

ROANOKE, VA., *October 15, 1926.*

Major H. M. TRIPPE,
*District Engineer, U. S. Engineer Office,*
*Huntington, West Virginia.*

DEAR SIR: We have received a copy of the notice issued by your office, of a public hearing to be held at Radford, Virginia, on October 28th to consider the application of the Appalachian Electric Power Company for a license to construct a water power development and dam across New River about a mile above the mouth of little River.

On behalf of this Company I have caused to be examined
3341 the map Exhibit "J" on file at the Post Office at Radford, Virginia. This map shows only the general location and the drainage area. No elevation or other detailed information, such as width of spillway, cross section of dam, etc., is given, but the map, together with the proposed height of 110 feet, indicates that the back water from this dam or the reservoir created thereby would extend just above our railroad bridge #1509 at Hiawassie, Virginia.

As near as we can determine with the information at hand, the proposed dam will raise the low water elevation under this bridge from one (1) to three (3) feet. Our records indicate that the high water of July 1916, was up so close to the steel work of this bridge that any addition to the height of the water would seriously threaten the safety of the bridge or wash it out entirely.

To raise the normal low water elevation would necessarily cause a raise in the high water elevation, especially since the reservoir

created below this bridge would be at least 18 miles long with practically no fall in that distance.

In addition, we have to reckon with the fact that New River rises several feet to the mile above our bridge at Hiawassie, and a condition thus created at this point on account of ice, which must be considered from the standpoint of safety to the bridge. It is well known that ice freezes quicker, harder and thicker in a pool where the current is almost negligible, and after rains and melting snows have put in motion the ice in the higher reaches of the river above the pool, these masses will move in considerable velocity until they reach the upper end of the pool where the ice will for sometime remain solid, and thereby cause the moving mass to roll up and accumulate great weight and force.

This accumulation will be a constant menace to the existence of the bridge, which is liable to be taken out entirely.

A similar condition already exists on the same stream at Fries Junction, where the same power company has a dam at
3342 Byllesby. In January 1918, the main span of this Company's bridge across the river at that point was taken out as the result of accumulated ice pressure and moved down the stream more than 100 feet, and a new span had to be constructed and the bridge restored at a very heavy expense. The public service was annulled for more than a week. The same condition was threatened at that point last year, but disaster was fortunately avoided by timely efforts, which brought about relief from the ice jam.

In view of these facts and conditions, which are apparent, this company deems it necessary for its own protection and that of the Public to oppose the construction of such a dam, the effect of which would be reasonably certain to bring disastrous consequences to its railroad as well as to its transportation business and service to the public, and it, therefore, deems it proper to bring to your attention its purpose to oppose the application of the Power Company for the license applied for to construct a dam at the point mentioned to the height contemplated in the application.

Yours truly,

(Signed) W. P. WILTSEE,
*Chief Engineer.*

Exhibit "C"

THE VIRGINIAN RAILWAY COMPANY

NORFOLK, VA., *October 25th, 1926.*

IN RE APPLICATION OF APPALACHIAN POWER COMPANY TO CONSTRUCT DAM ON NEW RIVER, VIRGINIA

Major H. M. TRIPPE,
*Corps of Engineers, U. S. A.,*
*Huntington, W. Va.*

DEAR SIR: In connection with the application to the Federal Power Commission of the Appalachian Power Company for "a license to construct a water power development and dam across New River at a point approximately one mile above the mouth of Little River and seven miles above the City of Radford, 3343 Virginia" a public hearing upon which will be held at the City of Radford, Virginia, on October 28th, 1926, the Virginian Railway Company hereby submits the following statement of its position in respect of said application:

The Virginian Railway Company does not object to the construction and operation of the proposed dam provided that the same shall be so constructed and operated as not to jeopardize or impede the operation of the Railway Company's property in respects hereinafter set forth.

The Virginian Railway between Mullens, West Virginia, and Roanoke, Virginia, a distance of 134 miles, is operated by electric locomotives. The current for operating said portion of the railway is supplied from a power house at Narrows, Virginia, containing four generators operated by steam with a capacity of fifty thousand kilowatts. It is contemplated as the demand for power for operating said portion of the railway increases, to add additional generators and the necessary boilers and machinery up to an ultimate capacity of above 80,000 kilowatts.

It is vitally important to the Railway Company that there shall be no interruption of the supply of power from said power station since unless such interruption was of very short duration the operation of the entire railroad would be paralyzed during such interruption.

Ninety per cent. of the business of the Railway Company is coal, nearly all of which originates west of the electrified portion of the railway, and the rest of which originates on the west end of such electrified portion of the railway, so that with the electrified portion of the railway out of operation it would be im-

possible to handle empty cars to or loaded cars from the mines and for such time as such interruption of service continued the portion of the railway operated by steam would be without any coal tonnage to handle.

The electrification of said portion of the railway with the present electrical equipment represents an expenditure of approximately $16,000,000.00 of which the power house at Narrows and the equipment thereof represents upwards of $4,000,000.00 In the operation of said power house large quantities of water are required for the condensers. New River at present
3344 affords an abundant supply and the necessary water is pumped from the river, passed through the condensers and discharged into New River with no appreciable loss of volume. The amount of water presently used is in excess of sixty thousand gallons per minute and the amount expected ultimately to be used will be in excess of one hundred and twenty thousand gallons per minute, which may be abundantly supplied from New River under normal conditions.

Accordingly The Virginian Railway Company prays that if a license be issued for the proposed dam it may be upon condition that said dam shall at all times be so operated as to pass through sufficient water, with the water entering New River below the dam, to afford all persons and property owners below the said dam, including said Railway Company, sufficient water for their needs.

A copy of this letter is being sent to the Federal Power Commission.

Yours very truly,

THE VIRGINIAN RAILWAY COMPANY,
C. H. HIX, *President.*

Exhibit "D"

In the Matter of The Application of Appalachian Electric Power Company, a Virginia corporation, to Federal Power Commission, Project No. 739. For a license, Project No. 739, with respect to water power development on the New River at a point approximately one mile above the mouth of Little River and seven miles above the City of Radford, Virginia, upon which application a public hearing has been advertised to be held in the Corporation Court Room at the City of Radford, Virginia, on Thursday, October 28th, 1926, at 1:00 P. M.

Electro Metallurgical Company, a Corporation duly created, organized and doing business under the laws of the State
3345 of West Virginia, and having its general office at No. 30 East 42nd Street, New York, owns and operates on the

Kanawha River, at Glen Ferris, West Virginia, a hydro electric development and large industrial works in connection therewith and also owns other extensive and valuable river front lands and power sites on the New River, the value of which for water power development and other purposes may be harmfully affected by the operation of the project set forth in the aforementioned Application, and Electro Metallurgical Company is consequently an interested party in the above-entitled matter.

The dam for water storage and water power development proposed in the afore-mentioned Application has possibilities not only of greatly benefiting but also of greatly damaging present or potential water power developments situated lower down in the New River and Kanawha River drainage basins. But, on the other hand, such dam and the appurtenant works could be so operated as to cause no interference with the natural flow of the said river and consequently not to affect water power developments down stream. However, the resultant effect on water power developments down stream from such dam may range all the way from important improvement, through neutral effect, to great injury, depending upon the manner in which and the extent to which the natural flow of the stream may be modified through the impounding of water behind such dam and its release therefrom.

The present power plant and industrial works of Electro Metallurgical Company are constructed and proposed extensions thereof are designated with respect to continuous twenty-four (24) hour day operation and any interference with the natural flow of the New River, (except reasonable regulation of such flow to produce and to continue uniformity thereof) that would prevent or curtail such twenty-four (24) hour day operation of the said power plant and industrial works and proposed extensions thereof, will seriously injure the commercial operation of the said power plant and proposed extensions thereof and increase the cost of the production of power thereat, and will also be immensely harmful to the operation of the said industrial works, and dependent upon the
3346 extent of such interference, might render the operation of said industrial works impracticable and render nonfeasible the proposed extension of such industrial works.

Electro Metallurgical Company does not hereby protest against the granting of the License applied for in the said application provided that such license shall impose such conditions that shall require the operation of the said project in a manner that shall not be harmful to the land, property or rights useful in the development of water power and for other purposes of Electro Metallurgical Company and others similarly situated, but is of the opinion that the project described in the aforementioned application, if properly operated, may be beneficial rather than

harmful to proposed and possible water power developments down stream from the site of said project.

Electro Metallurgical Company does hereby protest however against the granting by Federal Power Commission to the said Appalachian Electric Power Company of the License applied for in the aforementioned Application or any amendment thereof or any substitute therefor unless such License shall contain as a condition thereof a provision to the effect that no interference shall be permitted to be made in the flow past such dam as shall be authorized by or constructed in pursuance of such License, that may at any time restrict the natural flow of the said river or the continuous use thereof for power purposes at points down stream from such dam, in such manner that there would be through the operation of such dam or project, any diminution of the flow of the said river—

(1) either below the natural flow of the said river whenever its natural discharge is less than its mean natural discharge, or

(2) below the mean natural discharge of the said river whenever its natural discharge exceeds its mean natural discharge.

Respectfully submitted,

ELECTRO METALLURGICAL COMPANY,
By BEN J. SMITH, *Attorney.*

Major H. M. TRIPPE. I will now ask Judge Scott to present anything he desires for the Appalachian Electric Power Company.

Mr. SCOTT. Sometime ago the Appalachian Electric Power Company filed a declaration of intention under the last paragraph of Section 23 of the Water Power Act, which provides "that any person, association, corporation, State or municipality intending to construct a dam or other project works across, along, over, or in any stream or part thereof, other than those defined herein as navigable waters, and over which Congress has jurisdiction under its authority to regulate commerce between foreign nations and among the several States may in their discretion file declaration of such intention with the commission, whereupon the commission shall cause immediate investigation of such proposed construction to be made, and if upon investigation it shall find that the interests of interstate or foreign commerce would be affected by such proposed construction, such person, association, corporation, State or municipality shall not proceed with such construction until it shall have applied for and shall have received a license under the provisions of this act. If the commission shall not so find, and if no public lands or reservations are affected, permission is hereby granted to construct such dam

or other project works in such stream upon compliance with State laws."

I understand that the Commission has not yet passed upon that proposition. This proposition is made subsequent to that declaration of intention and subsequent to future action of the commission and in the event the commission decides to take jurisdiction then this application is to be considered. The plans and specifications of the proposed project are already on file for the inspection of anyone who may be interested. We, therefore, file this application under this statute as a whole, and submit the matter for the present to the consideration and determination of the commission.

I do not know that there is anything that I can add to what has already been done or to the proof that is already in. The nature and character of the proposed project is well known, and
3347 the character and nature of the stream is well known, and the navigation is a matter which is yet to be determined, and I do not understand whether that is expected to be gone into here or not.

Major TRIPPE. Have you anyone else that you care to present anything?

Mr. SCOTT. There is nothing further now. I may have to introduce someone later.

Major TRIPPE. I am now ready to hear anyone in opposition to the project.

Mr. HALL. I simply want to file a letter on behalf of the Virginian Railway Company, setting forth its position with reference to the construction of this dam. (Letter filed, marked "Exhibit-C.")

Major TRIPPE. Judge Scott, have you anything further you wish to say?

Mr. SCOTT. I just wish to state this in regard to the letters that have been read. I understand that those questions are not questions which are within the jurisdiction of the Federal Power Commission. The Federal Power authority is based upon the right to control navigable waters of the United States and to improve the navigable capacity of the stream below.

Major TRIPPE. Are there any further protests?

Mr. SCOTT. Mr. Chairman, I desire to state one thing further: I am requested by the Attorney General of the State of Virginia to state that his duties are such as to prevent his attendance here today, but he desires to preserve the right to file a petition against the commission asserting the jurisdiction of this project on two grounds, as I understand it, and they are as follows:

(1) That this stream is not a navigable stream within the County of Pulaski, it is not one of the navigable waters of the

United States and that this project cannot be so operated as to interfere with the navigable capacity of the stream, where it is navigable below Kanawha Falls.

(2) The State of Virginia desires to assert her rights to the control of this project both now and hereafter.

3348 That, as I understand, is the position of the Attorney-General and he will file in due time his position in writing.

Major TRIPPE. Are there any further protests to be heard?

As soon as the protests are all heard the meeting will be adjourned.

Major TRIPPE. Judge Scott have you anything further?

Mr. SCOTT. Nothing further.

Major TRIPPE. Anyone else?

Mr. R. J. NOELL. Our people here are very much interested in the building of this foundation. We think it is along the lines of a development in Virginia and I think the citizenship of Radford stands with absolute uninamity with the purpose of aiding the foundation wherever they can.

General Terry a number of years ago, got a bill through Congress asking for an expenditure of fifty thousand dollars for opening a channel for New River. It did not extend to Pulaski up above the mouth of Little River to Ingles Falls. In that connection I will say that some of the citizens here asked me to write to the Federal Power Commission and I received a letter stating that they would be very glad to get rid of this matter but that they did not think that they really had jurisdiction. I turned that letter over to the gentlemen who requested that I write it and I heard nothing further from them, possible they did have some meeting I do not know.

I waited sometime for some of our citizens to say something regarding this matter, but I think I have voiced the sentiments of our people here, that we would like to see this development go on.

Major TRIPPE. Anyone else desire to be heard?

A. H. CHUMBLEY. As Chairman of the Board of Supervisors of Pulaski County, I wish to state that Pulaski County is heartily in favor of this proposed project and the citizens as far as I have been able to ascertain are unanimous in desiring that permit be granted the Appalachian Power Company.

Major TRIPPE. Anyone else desire to be heard?

If not, the meeting will be adjourned, and is adjourned.

3349 STATE OF VIRGINIA,
*City of Radford, to-wit:*

I, Eugenia S. Herrick, a short-hand reporter do hereby certify that the foregoing is a full, true, and complete transcript of the

proceedings at the public hearing held in the Corporation Court Room, East Radford, Va. on October 29th, 1926, in the matter of the Application of the Appalachian Electric Power Company of Richmond, Virginia, to the Federal Power Commission, as reported by me in short-hand.

Given under my hand this 24th day of November, 1926.

EUGENIA S. HERRICK,
*Shorthand reporter.*

3350 STATEMENT FILED ON BEHALF OF APPLICANT, APPALACHIAN ELECTRIC POWER COMPANY, REGARDING PROTESTS TO THE FEDERAL POWER COMMISSION IN RESPECT TO GRANTING LICENSE FOR DEVELOPMENT No. 6.

Curtis, Mallet-Prevost, Colt & Mosle, Counsellors at Law, 30 Broad Street, New York

3351 5718–X.

STATEMENT ON BEHALF OF APPLICANT, APPALACHIAN ELECTRIC POWER COMPANY, REGARDING PROTESTS TO THE FEDERAL POWER COMMISSION IN RESPECT TO GRANTING LICENSE FOR DEVELOPMENT NO. 6

Protests have been received to date which, for convenience, will be referred to as follows:

1. By Public Service Commission of West Virginia, telegram dated October 28, 1926, supplemented by formal protest dated November 3, 1926;
2. By Electro-Metallurgical Company, undated;
3. By Norfolk & Western Railway Company, dated October 15, 1926;
4. By Virginian Railway Company, dated October 25, 1926;
5. By H. C. Quesenberry, dated November 11, 1926;
6. By Oren F. Dodds, dated October 26, 1926.

Protests Nos. 1 and 2 request protection of the flow below the proposed project, for purposes of power utilization and development. The rights of the protestants in this respect are governed by and protected under State laws.

The Federal Power Commission does not purport to grant, through the issuance of a license or otherwise, any rights to divert or change the flow of the stream, but only to regulate the flow as may strictly be required in the interests of navigation. By requiring that a licensee shall operate its project subject to such reasonable rules and regulations as may from time to time be imposed by the War Department in the interests of navigation the Commission confers upon the licensee no power or right to injure private property.

In respect of several licensees upon the same navigable
3352 stream the Federal Power Commission has jurisdiction to fix their respective rights, powers and duties to a certain extent, for example: to require, under the license terms prescribed in Section 10 (f) of the Water Power Act contribution from a lower licensee for headwater improvement by an upper licensee. However, neither protestant is a licensee under the Federal Water Power Act and it is submitted that the relative rights of the protestants and of the applicant are not to be determined by the Federal Power Commission, but are to be determined by and adjusted under the State laws.

As a practical matter, the plant of Electro-Metallurgical Company is so far below the applicant's proposed development, the intervening river contains such extensive storage from natural pools and gains such increases in flow from intervening tributaries, that any fluctuation will be absorbed and equalized by the time of reaching the Metallurgical Company's plant. The storage of water above the applicant's proposed dam and the use of such stored water in the economic manner required by applicant's extensive distribution service will benefit the Metallurgical Company and increase the annual K. W. H. output of its plant.

Protests 3, 4, and 5 are based upon property interests, entirely unrelated to the interests of navigation, and are accordingly subject to determination under State law or mutual adjustment between the respective protestants and the applicant.

Nevertheless, data is submitted regarding protests 3 and 4, which indicates that the property interests asserted by the respective protestants will not be adversely affected by the construction and operation of applicant's proposed project.

Protest No. 3, by the Norfolk & Western Railway Company, requests protection of the Company's railroad bridge at Hiwassie from injurious effects of floods and/or ice jams.

Attached, marked "Exhibit A," is profile of New River at and above location of proposed dam. Elevation 1841 intersects the present natural flood gradient some distance below Hiwassie
3353 Bridge and the retarding influence on flood flow at the bridge, if any would be so small as to be of no practical effect.

In the improbable event that a dangerous ice jam might form, the pond level of the proposed reservoir could quickly be drawn down by means of the flood gates in a manner to break up the ice jam as has been done in the pool levels above applicant's present dams Nos. 2 and 4.

Under protest No. 4 the Virginian Railway Company requests protection of its supply of condensing water for its steam power

generating plant at Narrows, Virginia, about 85 miles below applicant's proposed development. The present capacity of the plant is stated to be 50,000 K. W. and the ultimate capacity 80,000 K. W.

Applicant owns and operates a steam plant at Glen Lyn, 5 miles below the plant of protestant, with a present installed capacity of 80,000 K. W. and a contemplated ultimate capacity of 160,000 K. W. The Railway Company's plant receives the water prior to the applicant's plant and the condensor operation of the Railway Company raises the temperature of the water. The applicant is therefore required to operate its proposed development so as to maintain a flow sufficient for its own condensing requirements with approximately double the generating capacity of the Railway Company, after such water has already served the lesser condensing requirements of the Railway Company.

The property right asserted under protest No. 5 is subject to the condemnation laws of the State of Virginia.

Protest No. 6 is in the nature of a suggestion to the Commission of the advisability of adopting a new location for the dam. The merits of the suggested location have been thoroughly considered by the applicant.

Under protest No. 6 Mr. Dodds requests that the dam site be moved down from the present proposed location to Ingles Ferry, about two miles below, in order to include the drainage area of approximately 300 square miles of Little River.

In the opinion of the applicant's engineers the property
3354 cost involved by such relocation of the dam site would be excessive. The construction of a dam and reservoir at the proposed location would:

(a) destroy a valuable limestone quarry and crusher plant located on New River immediately above the mouth of Little River, which has required twenty years for development, employs a large number of men and is a very desirable industry for the locality, being especially favorably located for producing rock for requirements of railroads established in the region; it is stated to be valued at $700,000;

(b) submerge about two miles of Norfolk & Western Railway tracks over which much valuable freight business originates; the value of such trackage and business is stated by the Railway Company to be $900,000;

(c) submerge valuable property bordering Little River for many miles, completely submerging the towns of Graysonton and Snowville; and

(d) submerge the Radford municipal water power plant on Little River.

To relocate the dam site as suggested would not only destroy valuable local industry which it is the purpose of the applicant to promote rather than to destroy, but the additional cost for construction at such relocated dam site, in increased property expenditures, would make the new location one which appears at present to be economically prohibitive.

APPALACHIAN ELECTRIC POWER COMPANY,
By CURTIS, MALLET-PREVOST, COLT & MOSLE, *Counsel.*

Dated November 20, 1926.

3355 *Government exhibit No. 102*

5718–X

CURTIS, MALLET-PREVOST, COLT & MOSLE,
ATTORNEYS AND COUNSELLORS AT LAW,
*30 Broad Street, New York, September 2, 1926.*

FEDERAL POWER COMMISSION,
*Washington, D. C.*

Re Declaration of Intention of New River Development Company—Application for License, Appalachian Electric Power Company

DEAR SIRS: We beg to advise that Appalachian Electric Power Company, a Virginia public service corporation, has recently acquired, among others, the properties heretofore held by New River Development Company for the proposed development on New River in Pulaski County, Virginia, which has been the subject of a Declaration of Intention on the part of that Company before your Commission.

We enclose an instrument, substantially in the form approved by your counsel as advised in Major Edgerton's letter to us of December 19, 1925, which has been executed by New River Development Company and Appalachian Electric Power Company, whereby the former transfers to the latter its rights and the latter assumes the obligations, under the Declaration of Intention of New River Development Company.

In order to expedite matters, Appalachian Electric Power Company is adopting the suggestion made by you in your letter of July 1, 1925 and is submitting herewith an application for a license for the proposed project, upon the understanding that such application can be withdrawn if it should develop that a Federal license is not required.

Under these circumstances we request that action on the Declaration of Intention, referred to in your letter of August 19

1926, addressed to New River Development Company, be deferred for consideration at the same time as the application for license by Appalachian Electric Power Company.

3355–A The application of Appalachian Electric Power Company, executed in triplicate, is enclosed herewith but maps and drawings submitted as exhibits go forward under separate cover, rolled.

We should appreciate your early advice regarding arrangements for the publication of the required notice of application of Appalachian Electric Power Company for a license, which we should like to have commenced as soon as possible.

Very truly yours,

CURTIS, MALLET-PREVOST, COLT & MOSLE.
C. M. M.

Encl.

3356 *Government exhibit No. 103*

1925—Dec. 9—Telegram to Mr. Merrill, Executive Secretary, from Mr. Kramer re Pitt River.

3357 Western Union Telegram

Received at DA63 349 Collect Govt. NL 1/61, 1925 Dec 9 A. M. 5 14
San Francisco Calif 8.

O. C. MERRILL,
FEDERAL POWER COMMISSION,
*Washington, D. C.*

Refer your wire December three stop The following hourly fluctuations in second-feet fairly typical stop Pit three August nine at six A. M. to midnight two thousand seventy five then dropping sharply to fifteen fifteen then same to six A. M. August ten then increasing sharply to twenty one twenty five remaining same to midnight August ten then dropping sharply to fourteen forty and continuing at same to six A. M. August eleven stop Pit River at Henderson or Big Ben twenty sixty from eleven A. M. August nine to two thirty A. M. August ten then decreasing to fifteen sixty by five A. M. then continuing same to ten A. M. then increasing to twenty one fifty by ten thirty A. M. continuing same to four A. M. August eleven then dropping to fifteen sixty by six A. M. then decreasing at fourteen fifty by ten A. M. then increasing sharply stop Pit River at Ydalpom twenty three twenty August nine five P. M. continuing same to August ten seven A. M. then decreasing to seventeen eighty at eleven A. M. continuing about same to two P. M. then increasing to twenty three seventy at four thirty P. M. then about same to August eleven eight A. M. then decreasing to eight-

een fifty by ten thirty A. M. then decreasing to seventeen forty by two P. M. then increasing sharply stop Sacramento River at Red Bluff August eleven one A. M. top rather flat peak thirty seven eighty at ten thirty A. M. bottom through thirty four hundred at eleven P. M. top flat peak thirty eight ten August twelve ten thirty A. M. bottom through thirty four hundred at eight P. M. thirty eight thirty August thirteen ten thirty A. M. thirty three twenty stop Peaks on Sacramento rather flat lasting about eighteen hours troughs rather narrow lasting about three or four hours stop

3358 For discharge of twenty four sixty four Pit River at Big Bend has cross section nine hundred seventy square feet width one hundred fifty hydraulic radius five and eight tenths feet stop Can send hourly hydrograph for three points if desired wire stop The flow at Red Bluff was uniform prior to operation of Pit three.

KRAMER.

3359 *Government exhibit No. 104*

1925—Dec. 15—Letter to Mr. Merrill from Mr. Kramer re Pitt River and enclosing hydrographs.

3360 UNITED STATES DEPARTMENT OF AGRICULTURE
FOREST SERVICE, CALIFORNIA DISTRICT
FERRY BUILDING
*San Francisco, California, December 15, 1925.*

EXECUTIVE SECRETARY, *Federal Power Commission.*

DEAR MR. MERRILL: In accordance with your telegraphic request of December 3, 1925, I am enclosing a blue print roll containing hourly hydrographs for the month of August, 1925, for the Pit River at Pit 3, at Henderson, and at Ydalpom, and for the Sacramento River at Red Bluff. In accordance with the notation on the hydrographs, it was necessary to add 75 second feet to the hydrograph for the Pit River at Pit 3, in order to obtain the discharge of the stream below the powerhouse. The curve shows the flow through the powerhouse, and it is estimated by the Power Company that there was 75 second feet in the stream above the powerhouse.

An error of 24 hours was made in the records of the Pit River at Ydalpom in my telegram to you of December 8, 1925. One day should be subtracted from the dates given for this station.

The Pacific Gas & Electric Company furnished a hydrograph for the three stations on the Pit River, and on this hydrograph they had made an error for the Pit at Ydalpom for the entire month. The error was noted in this office when an attempt was made to estimate the lag between the Pit at Henderson and the Pit at Ydalpom; the lag actually being about 6 or 7 hours.

I am enclosing also rating tables and cross sections taken immediately opposite the gage for the Pit River at Henderson and at Ydalpom, and for the Sacramento River at Red Bluff.

I believe this is all the data that you asked for. It took some time to gather the data in this office and to make the corrections required by the discovery of the error in the Ydalpom records.

Very sincerely yours,

F. E. BONNER, *District Engineer.*
By E. W. KRAMER, *Acting.*

3361

## Rating Table

### PIT RIVER AT RED BLUFF GAGE

| Gage Height feet | Discharge Sec. Ft. | Gage Height feet | Discharge Sec. Ft. |
|---|---|---|---|
| 0.00 | 2640 | 1.00 | 4390 |
| .05 | 2720 | .05 | 4490 |
| .10 | 2810 | .10 | 4590 |
| .15 | 2900 | .15 | 4690 |
| .20 | 2980 | .20 | 4790 |
| .25 | 3060 | .25 | 4900 |
| .30 | 3150 | .30 | 5000 |
| .35 | 3240 | .35 | 5100 |
| .40 | 3320 | .40 | 5210 |
| .45 | 3400 | .45 | 5370 |
| .50 | 3490 | .50 | 5430 |
| .55 | 3580 | .60 | 5650 |
| .60 | 3660 | .70 | 5880 |
| .65 | 3740 | .80 | 6120 |
| .70 | 3830 | .90 | 6370 |
| .75 | 3920 | 2.00 | 6630 |
| .80 | 4010 | .10 | 6890 |
| .85 | 4100 | .20 | 7160 |
| .90 | 4200 | .30 | 7430 |
| .95 | 4300 | | |

### PIT RIVER AT YDALPOM GAGE

| | | | |
|---|---|---|---|
| 3.5 | 900 | .3 | 1630 |
| .6 | 1030 | .4 | 1710 |
| .7 | 1110 | .5 | 1800 |
| .8 | 1190 | .6 | 1900 |
| .9 | 1270 | .7 | 2010 |
| 4.0 | 1350 | .8 | 2130 |
| .1 | 1440 | .9 | 2250 |
| .2 | 1530 | 5.0 | 2370 |

### PIT RIVER AT HENDERSON GAGE (BIG BEND)

| | | | |
|---|---|---|---|
| 6.5 | 580 | .2 | 2220 |
| .6 | 650 | .3 | 2370 |
| .7 | 720 | .4 | 2520 |
| .8 | 790 | .5 | 2680 |
| .9 | 860 | .6 | 2840 |
| 7.0 | 930 | .7 | 3000 |
| .1 | 1010 | .8 | 3170 |
| .2 | 1090 | .9 | 3350 |
| .3 | 1180 | 9.0 | 3530 |
| .4 | 1270 | .1 | 3720 |
| .5 | 1360 | .2 | 3910 |
| .6 | 1460 | .3 | 4110 |
| .7 | 1570 | .4 | 4310 |
| .8 | 1690 | 9.5 | 4520 |
| .9 | 1810 | .6 | 4730 |
| 8.0 | 1940 | 11.6 | 9640 |
| .1 | 2080 | .7 | 9000 |

| Gage Height feet | Discharge Sec. Ft. | Gage Height feet | Discharge Sec. Ft. |
|---|---|---|---|
| 3382 .7 | 4940 | | |
| .8 | 5180 | .4 | 9120 |
| .9 | 5390 | .5 | 9380 |
| 10.0 | 5620 | .8 | 10160 |
| .1 | 5860 | .9 | 10420 |
| .2 | 6100 | 12.0 | 10680 |
| .3 | 6340 | .1 | 10940 |
| .4 | 6590 | .2 | 11200 |
| .5 | 6840 | .3 | 11470 |
| .6 | 7090 | .4 | 11740 |
| .7 | 7340 | .5 | 12010 |
| .8 | 7590 | .6 | 12280 |
| .9 | 7840 | .7 | 12550 |
| 11.0 | 8090 | .8 | 12820 |
| .1 | 8340 | .9 | 13090 |
| .2 | 8600 | 13.0 | 13360 |
| .3 | 8860 | | |

3365 *Government exhibit No. 105*

1927—May 2—Letter from Mr. Bonner to Mr. Merrill enclosing copy of Kramer's report on Klamath River.

3366 UNITED STATES DEPARTMENT OF AGRICULTURE FOREST SERVICE, CALIFORNIA DISTRICT

FERRY BUILDING,
*San Francisco, California, May 2, 1927.*

EXECUTIVE SECRETARY,
*Federal Power Commission, Washington, D. C.*

DEAR MR. MERRILL: I am forwarding you herewith one copy of the "Report on Effect of Streamflow Regulation at the Copco Power Plants of the California Oregon Power Company on the Flow of the Klamath River", by E. W. Kramer, dated April 28, 1927.

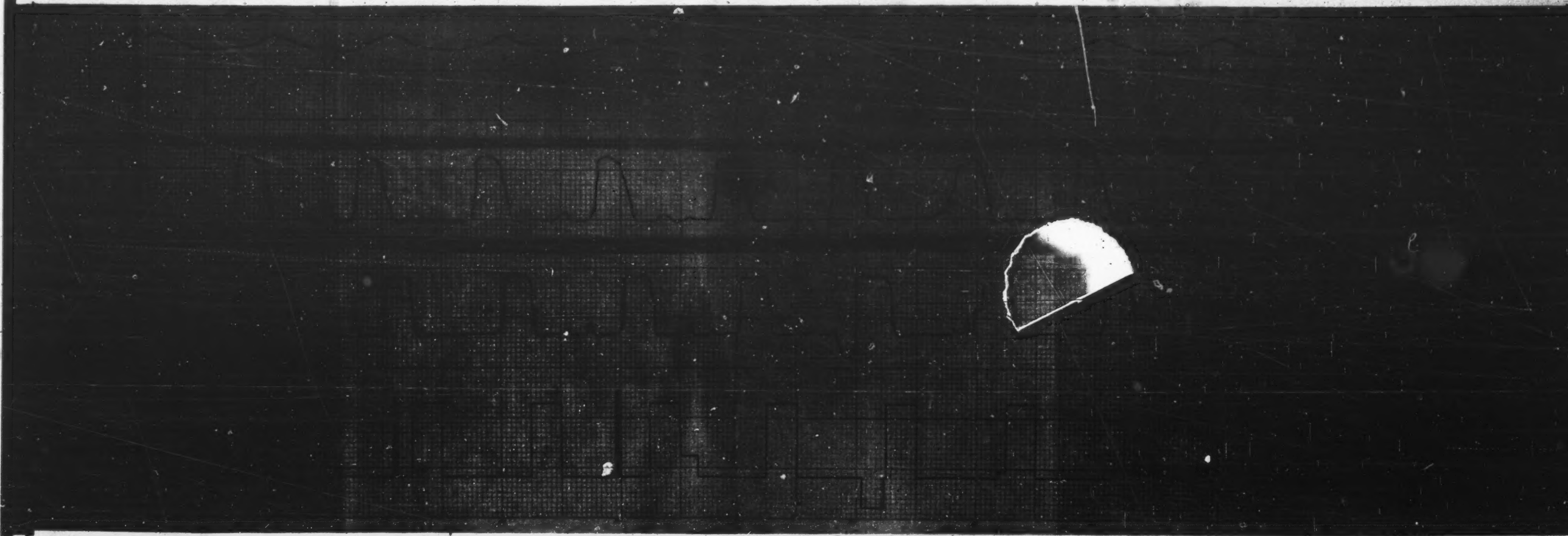
It is hoped that the data contained in this report will be of value to you in connection with your study of the New River Development Company project.

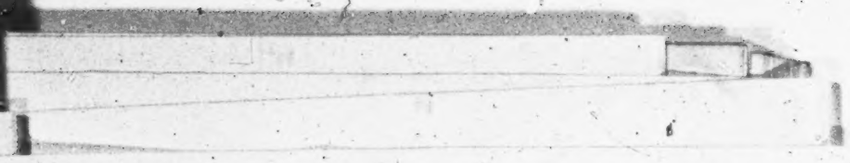
This office has given some consideration to the idea of working up a technical paper on this subject in case you have no objection. I will be glad to learn of your feelings in this regard.

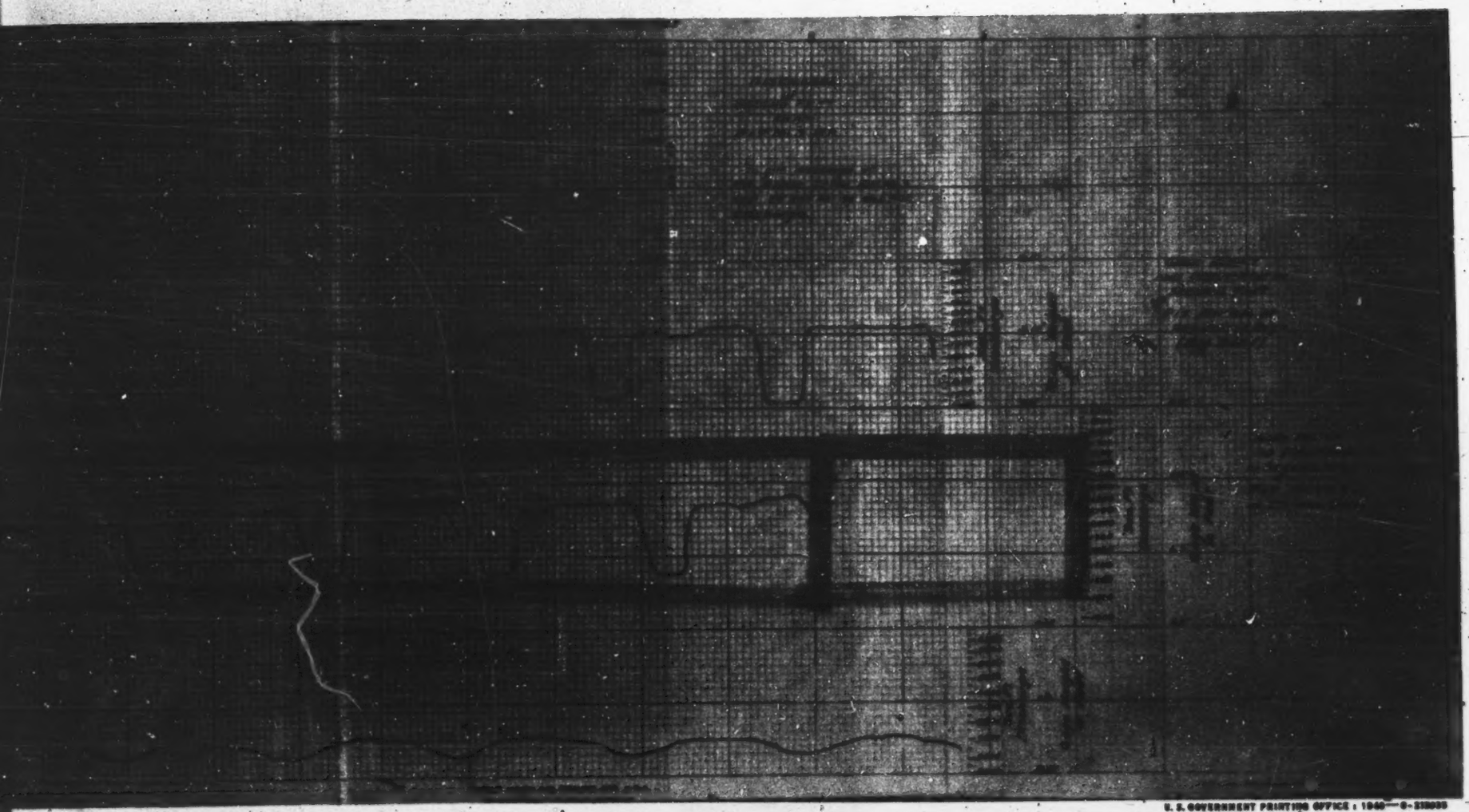
Yours very truly,

F. E. BONNER, *District Engineer.*

2628-E







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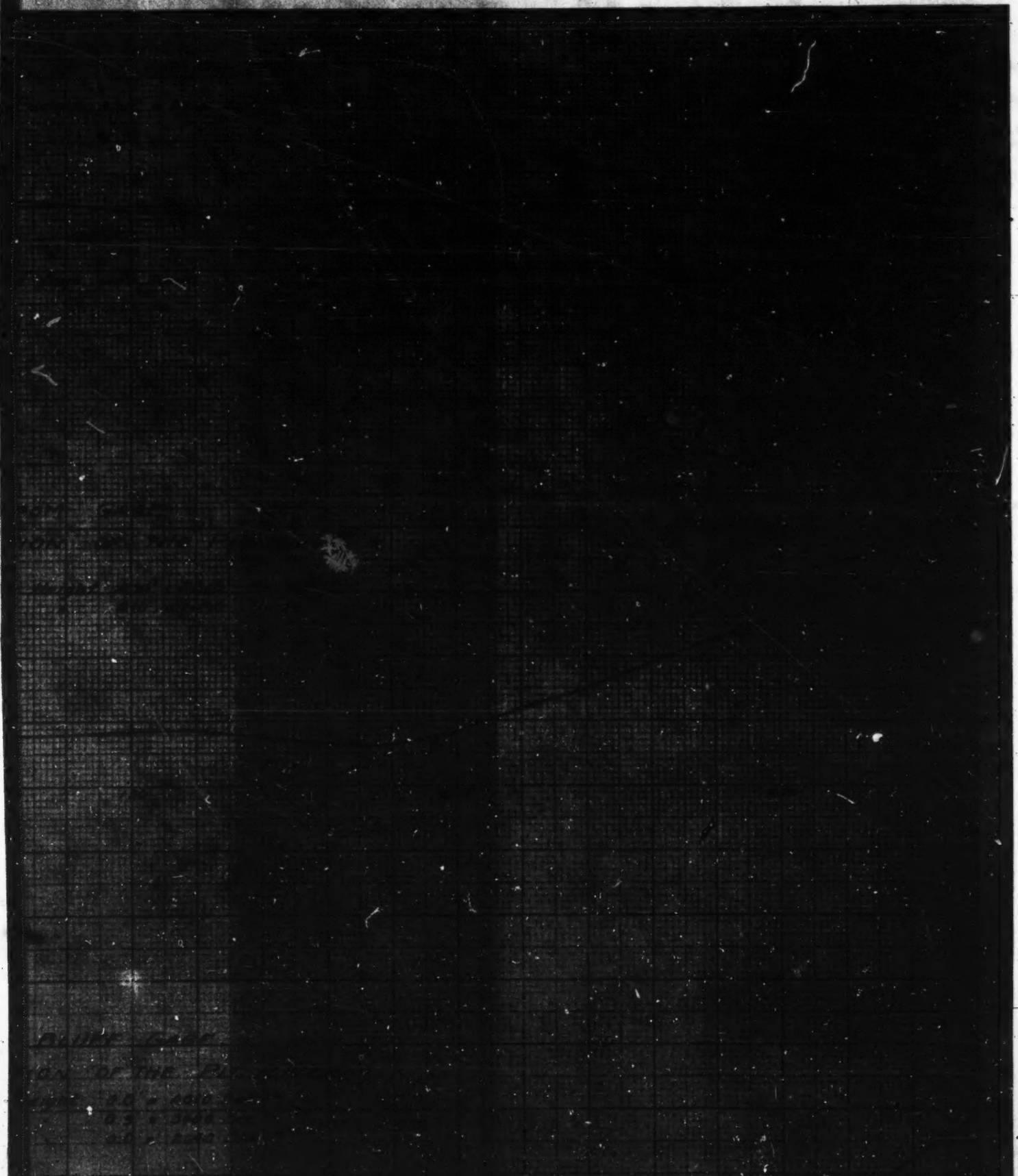

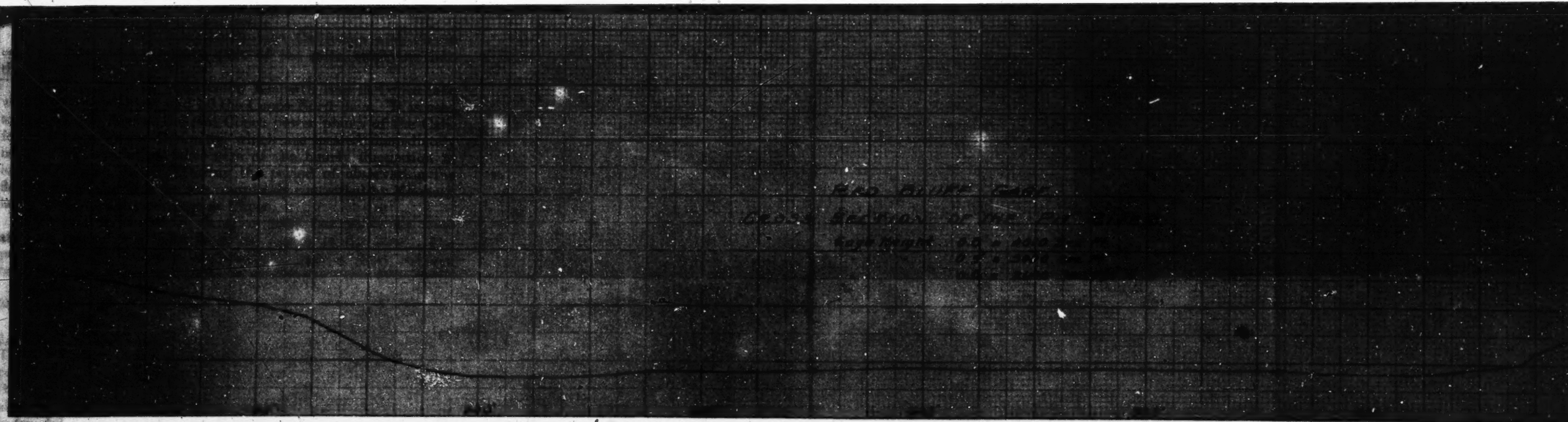

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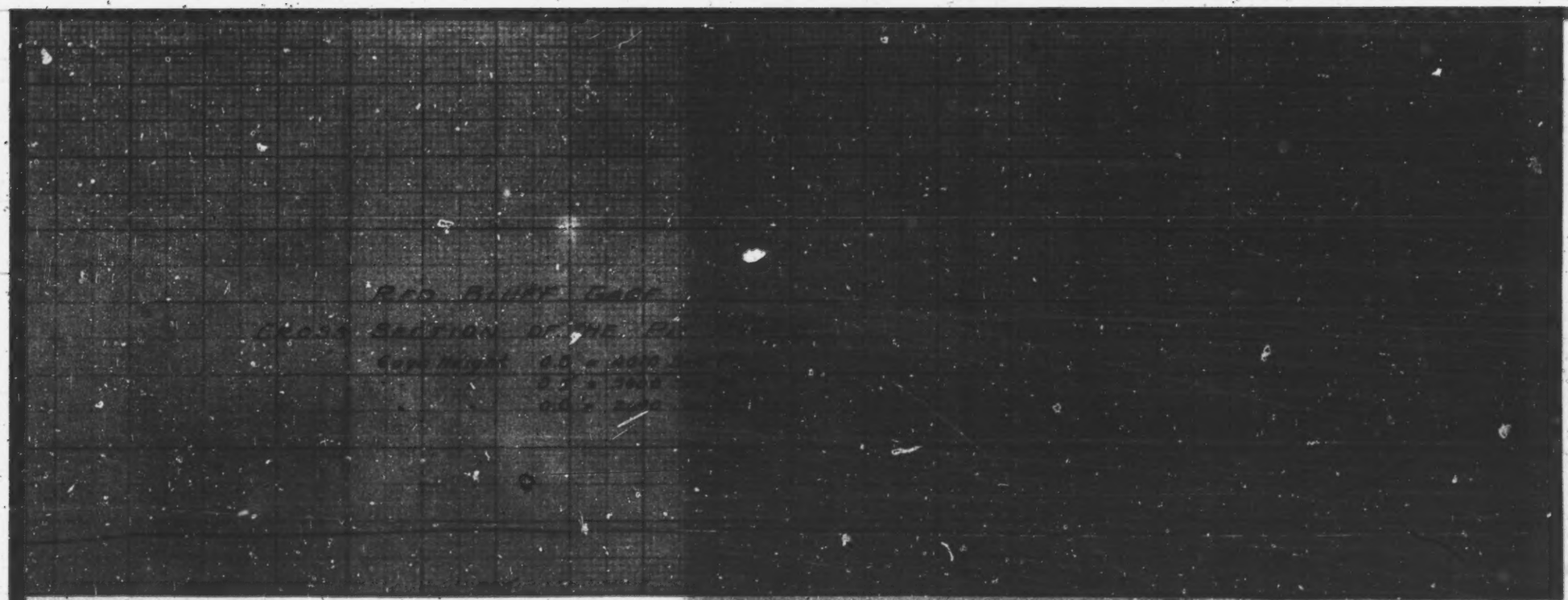


3367 REPORT ON EFFECT OF STREAMFLOW REGULATION AT THE COPCO POWER PLANTS OF THE CALIFORNIA-OREGON POWER COMPANY ON THE FLOW OF THE KLAMATH RIVER

By E. W. Kramer, Hydraulic Engineer, U. S. Forest Service, San Francisco, Calif.

3368 REPORT ON EFFECT OF STREAMFLOW REGULATION AT THE COPCO POWER PLANTS OF THE CALIFORNIA OREGON POWER COMPANY ON THE FLOW OF THE KLAMATH RIVER

During the period from February 11 to February 17, 1927, inclusive, Mr. John H. Lawrence, and the writer made an investigation of the wave effects in the Klamath river due to the regulation of the flow at the Copco reservoir of the California-Oregon Power Company. A very appreciable amount of assistance was rendered by the officials of the California Oregon Power Company and by Mr. Carl Langford of the Electro Metals Company, the latter company being interested in power developments in the lower reaches of the stream.

The Klamath river rises in southeastern Oregon in Upper Klamath lake. The lake has a very great area. The height of the water in the lake is controlled for power use by the California-Oregon Power Company.

The Klamath river flows south into California and thence eastward across the northern part of the state, emptying into the Pacific Ocean.

At a point about 51 miles below Klamath lake is Copco lake which is a reservoir created by the Copco No. 1 dam. It is used to regulate the flow at the two Copco power plants of the California-Oregon Power Company, which are located immediately below. The regulation takes care of the hourly fluctuation in load at the two plants. During the period of observation the flow of the Klamath river was completely controlled by Klamath lake storage and the pondage at Copco.

Copco lake is located at elevation 2,613 feet above sea level at a distance of 200 miles from the mouth of the river. The power company maintains an automatic gage a short distance below the Copco No. 2 tailrace at approximate elevation 2,320 feet.

3369 Located 64 miles below the Copco gage is the Seiad gage of the U. S. Geological Survey at approximate elevation 1,380 feet. The fall of the river in this distance totals 940 feet. The grade is very uniform amounting to a slope of about 14.7 feet per mile. For the most of this distance the river is flowing through the Siskiyou mountains. The width of the channel is about 200 feet. It is lined with boulders and sand, but in general is free from vegetation or debris such as logs.

Located 132 miles below the Copco gage is the Bedrock Island gage of the Electro Metals Company at elevation approximately 500 feet above and 66.5 miles from the sea. The channel of the river between the Seiad and the Bedrock Island gages, is wider, somewhat rockier and much more crooked than between the Copco and the Seiad gages. The total fall between the two gages is 880 feet, and is distributed very uniformly, the average fall being 13.0 feet per mile. The tributary drainage area between the two points is 838 square miles.

From the Bedrock Island gage to the mouth of the Trinity River, the most important tributary of the Klamath River, the distance is 24 miles. The fall per mile is 16.3 feet. This stretch of the stream is straighter than the stretch between the Seiad and Bedrock Island gages.

From the mouth of the Trinity River to the ocean is about 42.5 miles. The total drop is 110 feet or 2.58 feet per mile. This section of the stream is much wider, especially, for the last 18 miles above the mouth of the river.

The following table gives the drainage area at the three gages and at the mouth of the river.

3370 TABLE NO. 1

| Station | Drainage area (square miles) |
|---|---|
| Copco gage | 3,566 |
| Seiad gage | 5,845 |
| Bedrock Island gage | 6,683 |
| Requa | 11,060 |

The tributary drainage area between the Copco and the Seiad gages of 2,279 square miles ranges in elevation from 1,380 feet along the river to 14,380 feet at the crest of the highest peak (Mt. Shasta). Most of the mountains and ridges only reach an elevation of 6,000 feet. The snow line seemed to be approximately at about elevation 3,200 feet. With the exception of the Shasta valley which is about 25 miles long by 12 miles wide, this area is entirely mountainous.

The area tributary to the river between Seiad and Bedrock Island gages of 838 square miles is entirely mountainous, the ridges and slopes ranging from a minimum of 500 feet along the river to 7,451 feet at the highest peak (Black Mountain). Most of the ridges only reach an elevation of about 4,800 feet. During the period of observation, this area was receiving slightly more precipitation and the temperature was slightly warmer than for the area between Seiad and Copco. The run off per square mile was much greater.

At the beginning of the observations the roads and soil on both sides of the river from Copco down to the Seiad gage and for some distance below was frozen hard nights, but thawed out every day before noon. It is not known to exactly what elevation this thawing extended. The weather warmed up somewhat on February 14th and from then on the temperature varied but little throughout the twenty four hours except, of course, that it was considerably warmer in the sun when it shone. It did not freeze at night along the river. The following tables give the temperature and the condition of the weather throughout the period of the study of the nearest Weather Bureau stations.

3371 TABLE No. 2—TEMPERATURE FEBRUARY 1927

| Station | 10 | | 11 | | 12 | | 13 | | 14 | | 15 | | 16 | | 17 | | 18 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Max. | Min. | Max. | Min. | Max. | Min. | Max. | Min. | Max. | Min. | Max. | Min. | Max. | Min. | Max. | Min. | Max. | Min. |
| Yreka, Cal. | 46 | 21 | 51 | 20 | 47 | 20 | 49 | 20 | 52 | 32 | 51 | 34 | 48 | 27 | 47 | 31 | 53 | 35 |
| | Clear | | Clear | | Clear | | Clear | | Pt. Cloudy | | Cloudy | | Cloudy | | Cloudy | | Pt. Cloudy | |
| Orleans, Cal. | 60 | 30 | 60 | 31 | 60 | 32 | 60 | 31 | 57 | 35 | 48 | 38 | 50 | 43 | 48 | 42 | 51 | 43 |
| | Clear | | Clear | | Clear | | Pt. Cloudy | | Cloudy | | Cloudy | | Cloudy | | Cloudy | | Cloudy | |

NOTES.—Observations at Yreka are taken at 8 A. M. for the preceding 24 hours; observations at Orleans are taken at 7:30 A. M. for the preceding 24 hours.

3372 TABLE No. 3.—PRECIPITATION, FEBRUARY, 1927

| Station | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
|---|---|---|---|---|---|---|---|---|---|
| Yreka, Cal. | 0 | 0 | 0 | T | 0 | T | .15 | .92 | .12 |
| Scott's Bar, Cal. | 0 | 0 | 0 | 0 | 0 | .20 | .20 | .26 | 1.75 |
| Happy Camp, Cal. | 0 | 0 | 0 | 0 | 0 | .53 | .85 | .56 | 0 |
| Orleans, Cal. | 0 | 0 | 0 | 0 | .21 | .45 | .80 | 1.35 | 1.04 |

NOTES.—Observations at Yreka are taken at 8 A. M. for the preceding 24 hours. Observations at Orleans are taken at 7:30 A. M. for the preceding 24 hours. Observations at Scott's Bar are taken at 5 P. M. for the preceding 24 hours.

3373 The automatic gage at Copco was used to show the flow there and readings were made every half hour on the Seiad and Bedrock Island gages, which are located 64 and 132 miles below, respectively.

The volume of flow of the Klamath river from the mouth of the Trinity river to the mouth of the Klamath river at Requa and the great changes in daily flow between these points due to changing weather conditions in the watershed tributary to the Klamath river below the Bedrock Island gage make the effect of the Copco regulation almost negligible in this section of the stream at this time of the year. For instance, on February 18, 1927, at 6:30 P. M. the Requa gage read 20.9 feet and at 12 P. M. 21.9 feet, the corresponding flows being 71,500 and 88,900 second-feet. Therefore no attempt was made to trace the wave effects

below the Trinity. The gage reader at the Requa gage at the mouth of the Klamath informed me that during the low flow period there was a daily rise and fall on the gage of from 0.5 feet to 0.7 feet due to the Copco regulation. The low flow at Requa ranges around 1,600 second-feet.

Observations were begun at 11 A. M. February 11th on the Copco gage, at 4 P. M. February 12th on the Seiad gage, and at 6 P. M. February 12th on the Bedrock Island gage. They were discontinued at midnight February 17th at the Copco gage, at midnight February 16th on the Seiad gage, and at 4:30 P. M. February 17th on the Bedrock Island gage.

It is not believed that there was sufficient precipitation falling during this period to affect the results. It is probable that the daily variation of temperature on the snow caused some hourly fluctuation in the run off. This, however, was as little as could be expected from any stream running from a watershed partly snow covered. It will be noted from Table 2 that the weather was cloudy for a very considerable period. There was very little hourly variation of temperature during the cloudy days.

3374 The Copco gage is an automatic gage. It was inspected each day to make sure that it was operating properly during the period of experiment. The California-Oregon Power Company was regulating the flow at the Copco plant daily during this period from a minimum of 255 second feet to a maximum of about 2,600 second feet, the actual maximum during the period being about 2,800 second feet.

The change in flow at the Copco gage is very rapid as will be noted by inspection of Plate 3. Ordinarily the flow through the plants from about midnight to about 6 A. M. is only 255 second feet. At 6 A. M. the flow is usually increased suddenly about 2,000 second feet, and it then increases more gradually to a daily maximum of from 2,600 to 2,800 second feet, which it reaches about noon. It then decreases to about 2,400 second feet at about 10 or 11 P. M. when it is shut off again to about 255 second feet. A study of plate 3 shows that the flow is much less for Sunday than for other days. On this account the study was begun on Friday in order to make sure a Sunday would be included. The low Sunday flow can be easily identified at the two points of observation below.

The Seiad gage is a staff gage. This station has been accurately rated by the U. S. Geological Survey.

Plate 3 indicates that it took the front of the wave created by suddenly increasing the flow 2,000 second feet at Copco, about thirteen hours to travel from Copco to the Seiad gage which is at the rate of 7.22 feet per second or about five miles per hour. The rise seems to be almost as rapid at Seiad as at Copco gage.

The amplitude of the wave front at Seiad seems to be almost exactly the same as at the Copco gage, the flow varying from 3,000 second-feet to 5,600 second-feet. The rear of the wave caused by decreasing the flow at the Copco gage is not abrupt as is the wave front. The back of the wave seems to lag, making a sloping profile,
3375 which, however, reaches a sharp valley at the minimum flow. The maximum amplitude from the lowest valley to the crest of the wave is as great at Seiad as at Copco.

A study of plate 3 indicates that the wave front caused by suddenly increasing the flow at Copco requires about 11 to 11½ hours to travel the 68 miles from Seiad to Bedrock Island, which is at the rate of about 9.07 feet per second. The wave front is somewhat less steep and the rise less sudden at Bedrock Island that it is at Seiad. As at Seiad, the valley is considerably filled by the water lagging from the rear of the wave. The amplitude of the waves at Bedrock Island seems to be about 75% of the Copco and Seiad amplitudes.

The average flow for corresponding 24 hour periods was computed by averaging the flows observed for each half hour reading. Allowances of 13 hours and 11 hours, respectively, were made in selecting these periods for the water to travel from Copco to Seiad and from Seiad to Bedrock Island (See Table 4).

The average flow at the gages for the four day period beginning 3 A. M., February 12, 1927, at the Copco gage and for the corresponding periods at the two lower gages, making the above described allowances, was 1,525 second feet at Copco, 4,264 second feet at Seiad and 9,804 second feet at Bedrock Island.

The increase or decrease for each day over the preceding day at any gage is also shown on Table 4. There was no great change in streamflow during the period. For instance, for the first day at Copco the mean flow was 1,634 second feet, and for the last day 1,784 second feet; for Seiad 4,445 second feet and 4,462 second feet; and for Bedrock Island 10,414 second feet and 9,952 second feet.

It will be noted that the daily differences are very nearly the same for Copco and Seiad, but are quite different for Bedrock Island.

The conclusion reached by the writer is that in a stream of this character the wave front travels downstream faster than
3376 the low valley preceding it, the water in the front constantly overtaking the water ahead of it on account of the greater slope of the water surface at the wave front and the greater hydraulic radius. This tends to make the wave front very steep, and to make a sharp trough or valley, immediately ahead of the front.

The lagging of the water in the rear of the wave, which tends to fill the valley is less easy to understand. It is apparent, however, that this lagging occurs. On the other hand the extreme ampli-

tude of the wave seems in this case to be unaffected as far as the Seiad gage, and to not be greatly affected as far as the Bedrock Island gage or for a distance of 132 miles. However, it is probable that the valley or trough would be entirely filled ultimately at a sufficient distance below by the lagging of the rear of the wave and the gaining of the wave front on the water traveling in the trough.

E. W. KRAMER, *Hydraulic Engineer.*

Approved:
F. E. BONNER, *District Engineer.*
APRIL 28, 1927.

3377 TABLE No. 4.—AVERAGE DAILY RUN OFF KLAMATH RIVER, FEBRUARY 1927

| Copco gage | | | Seiad gage | | | Bedrock Island gage | | |
|---|---|---|---|---|---|---|---|---|
| 24-hour periods ending | Mean flow | Difference from preceding day | 24-hour periods ending | Mean flow | Difference from preceding day | 24-hour periods ending | Mean flow | Difference from preceding day |
| | *Sec. ft.* | *Sec. ft.* | | *Sec. ft.* | *Sec. ft.* | | *Sec. ft.* | *Sec. ft.* |
| 3:00 A.M. 2/13/27 | 1,634 | | 4:00 P.M. 2/13/27 | 4,445 | | 3:00 A.M. 2/14/27 | 10,414 | |
| 3:00 A.M. 2/14/27 | 1,143 | −491 | 4:00 P.M. 2/14/27 | 3,862 | −583 | 3:00 A.M. 2/15/27 | 9,298 | −1,116 |
| 3:00 A.M. 2/15/27 | 1,540 | +397 | 4:00 P.M. 2/15/27 | 4,285 | +423 | 3:00 A.M. 2/16/27 | 9,551 | +253 |
| 3:00 A.M. 2/16/27 | 1,784 | +244 | 4:00 P.M. 2/16/27 | 4,462 | +177 | 3:00 A.M. 2/17/27 | 9,952 | +401 |
| Mean for period | 1,525 | | | 4,264 | | | 9,804 | |

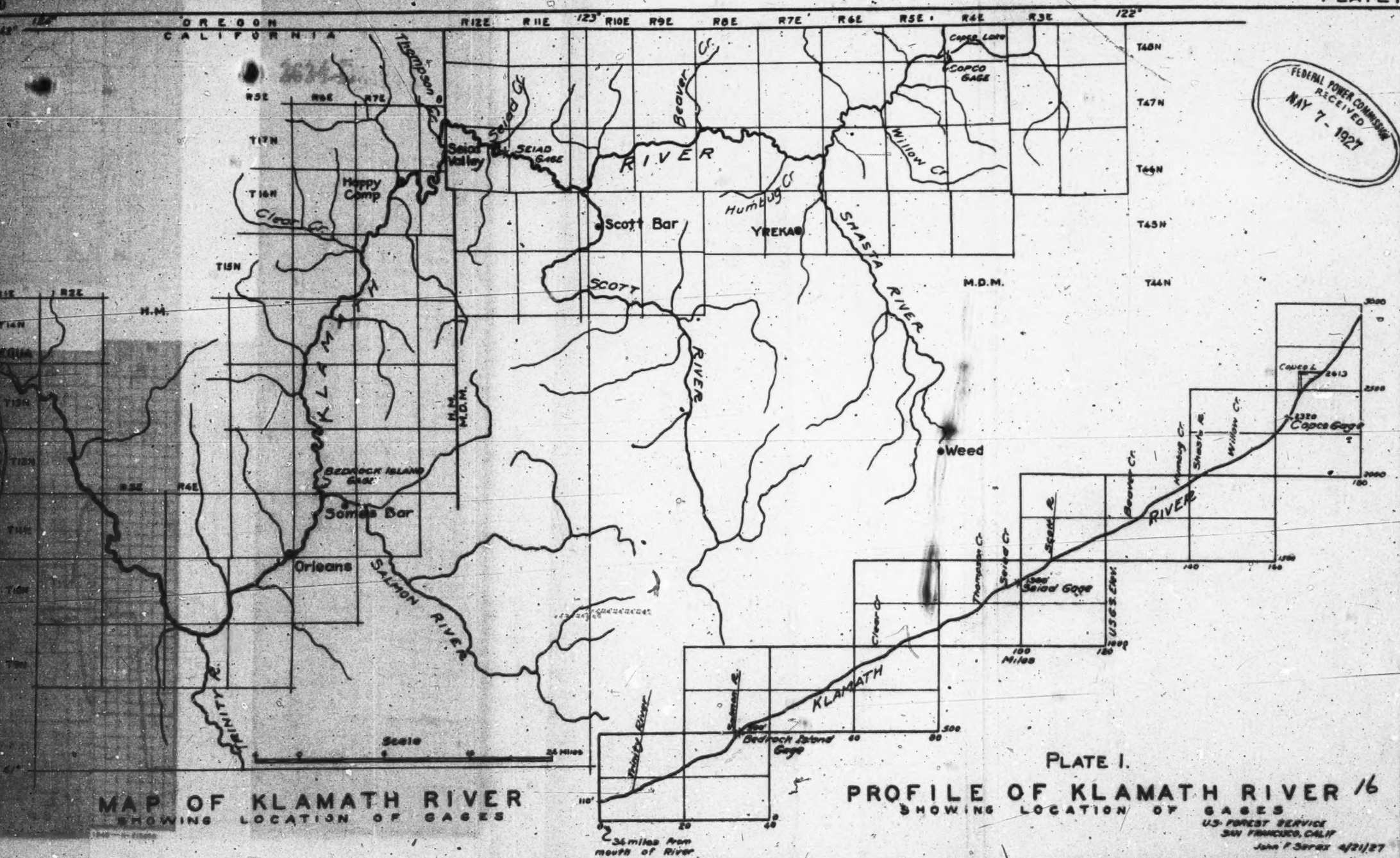
NOTE.—Thirteen hours is allowed for water to flow from Copco to Seiad and 11 hours from Seiad to Bedrock Island.

3378 TABLE No. 5.—RATING TABLE FOR KLAMATH RIVER, SEIAD VALLEY, CALIF., FROM OCT. 1, 1923, TO JUNE 30, 1925

| Gage height | Discharge | Gage height | Discharge | Gage height | Discharge | Gage height | Discharge | Gage height | Discharge |
|---|---|---|---|---|---|---|---|---|---|
| Ft. | Sec. ft. | Ft. | Sec. ft. | Ft. | Sec. ft. | Ft. | Sec. ft. | Ft. | Sec. ft. |
| 2.00 | 435 | 4.00 | 2,120 | 6.00 | 5,550 | 8.00 | 10,000 | 10.00 | 15,300 |
| .10 | 480 | .10 | 2,200 | .10 | 5,750 | .10 | 10,240 | .10 | |
| .20 | 530 | .20 | 2,400 | .20 | 5,960 | .20 | 10,480 | .20 | |
| .30 | 585 | .30 | 2,540 | .30 | 6,170 | .30 | 10,730 | .30 | |
| .40 | 640 | .40 | 2,690 | .40 | 6,380 | .40 | 10,980 | .40 | |
| .50 | 700 | .50 | 2,840 | .50 | 6,590 | .50 | 11,230 | .50 | |
| .60 | 760 | .60 | 2,990 | .60 | 6,810 | .60 | 11,480 | .60 | |
| .70 | 825 | .70 | 3,150 | .70 | 7,030 | .70 | 11,740 | .70 | |
| .80 | 895 | .80 | 3,310 | .80 | 7,250 | .80 | 12,000 | .80 | |
| .90 | 965 | .90 | 3,480 | .90 | 7,470 | .90 | 12,260 | .90 | |
| 3.00 | 1,040 | 5.00 | 3,650 | 7.00 | 7,690 | 9.00 | 12,520 | 11.00 | 17,300 |
| .10 | 1,120 | .10 | 3,830 | .10 | 7,910 | .10 | 12,780 | .10 | |
| .20 | 1,200 | .20 | 4,010 | .20 | 8,140 | .20 | 13,050 | .20 | |
| .30 | 1,290 | .30 | 4,200 | .30 | 8,370 | .30 | 13,320 | .30 | |
| .40 | 1,390 | .40 | 4,390 | .40 | 8,600 | .40 | 13,590 | .40 | |
| .50 | 1,500 | .50 | 4,580 | .50 | 8,830 | .50 | 13,870 | .50 | |
| .60 | 1,610 | .60 | 4,770 | .60 | 9,060 | .60 | 14,150 | .60 | |
| .70 | 1,730 | .70 | 4,960 | .70 | 9,290 | .70 | 14,430 | .70 | |
| .80 | 1,860 | .80 | 5,150 | .80 | 9,520 | .80 | 14,720 | .80 | |
| .90 | 1,990 | .90 | 5,350 | .90 | 9,760 | .90 | 15,010 | .90 | |
| 4.00 | | 6.00 | | 8.00 | | 10.00 | | 12.00 | |

2634-A

PLATE I




MAP OF KLAMATH RIVER
SHOWING LOCATION OF GAGES

PLATE I.
PROFILE OF KLAMATH RIVER
SHOWING LOCATION OF GAGES

U.S. FOREST SERVICE
SAN FRANCISCO, CALIF
John F. Serex 4/21/27

FEDERAL POWER COMMISSION
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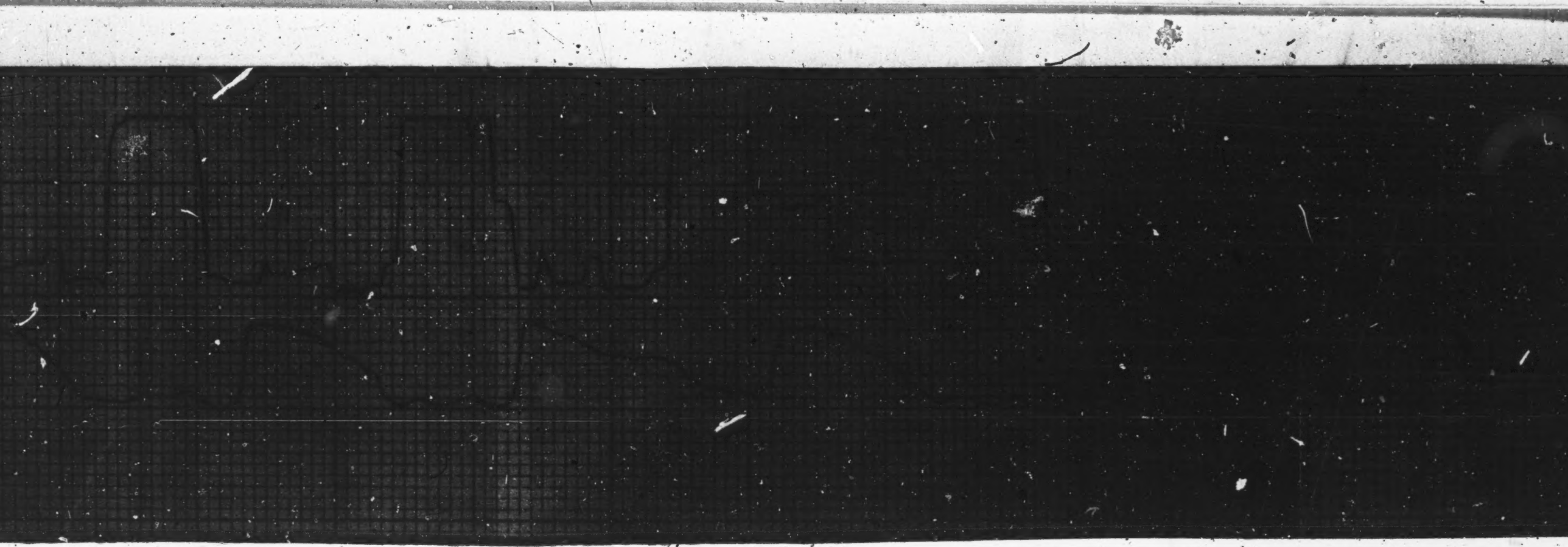
PLATE 2.



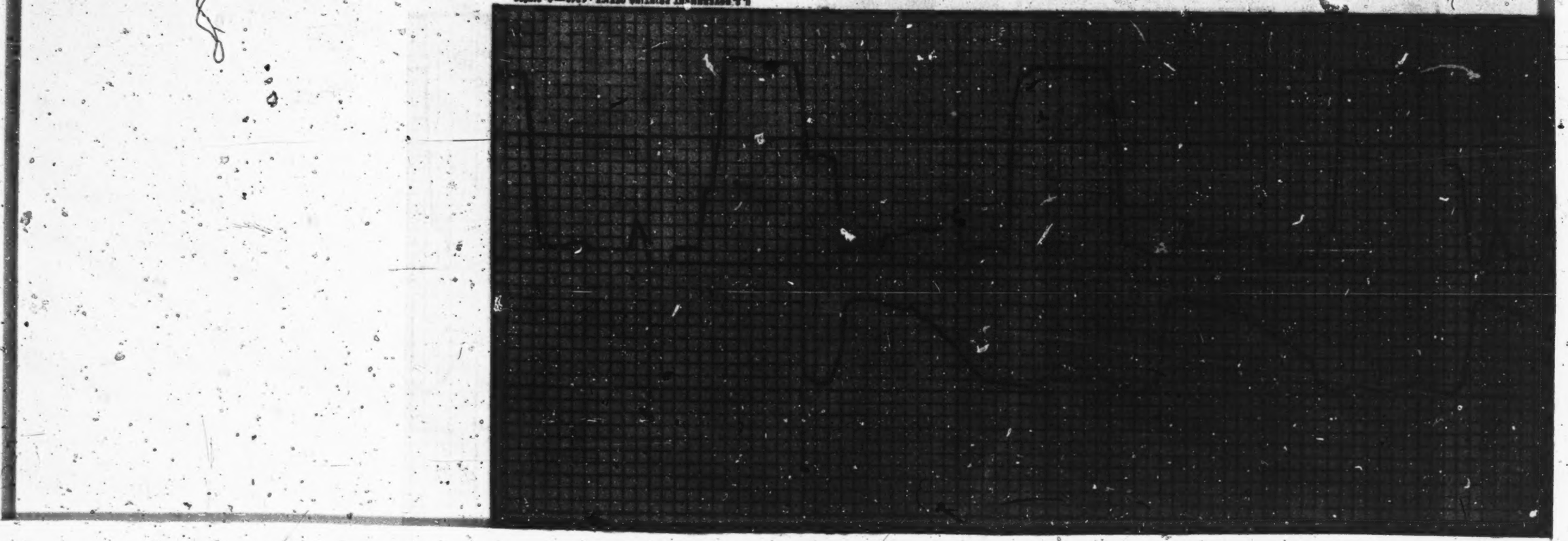


PLATE 3.

U. S. GOVERNMENT PRINTING OFFICE : 1940—O-[illegible]

3383 *Government exhibit No. 106*

1926, Oct. 24—"Memorandum to Federal Power Commission re Declaration of Intention of New River Development Company," prepared by Curtis, Mallet-Prevost, Colt & Mosle. (Original Exhibit.)

*Government exhibit No. 106–A*

1925, Oct. 23—Letter from L. J. Bevan to C. M. Micou, re drainage areas and runoff. (Original Exhibit.)

3384 *Government exhibit 106–B*

Memorandum of Request of New River Development Company in regard to Report of Chief of Engineers dated August 20, 1925, upon the proposed project of the company for a water power development on New River, in Virginia, with respect to which declaration of intention has been filed by the company with the Federal Power Commission.

On behalf of New River Development Company it is respectfully requested that the Chief of Engineers take under reconsideration the report of August 20, 1925 above-mentioned and consider making findings as follows:

A. As to navigability of New River

1. That New River is not navigable in fact in Virginia.

It is felt that such a finding is warranted by—

(a) Consideration of the War Department reports setting forth the conditions disclosed in and the results obtained by the attempted improvement of the river. Particular reference is made to the following:

For general conditions and nature of improvements required, Report of W. P. Smith, Engr., to Major Wm. P. Craighill, dated Jan. 10, 1879, An. R., C. of E. 1879, pg. 540 et seq.; also An. R., C. of E. 1878, pg. 498. For isolation of work in three sections, Rept. of Lieut. Col. Wm. P. Craighill, An. R., C. of E., 1883, pg. 702. For necessity of appropriation for maintenance, if improvement completed, Report of Capt. Jas. W. Cuyler to Major Wm. P. Craighill, July 3, 1879, An. R., C. of E. 1879, pg. 531.

(b) The specific finding dated June 18, 1910, by the Chief of Engineers, General W. H. Bixby, that New River is not navigable at Ivanhoe, Virginia, distant some 40 miles above the proposed project. (See report on pending bill, H. R. 26411 (61st
3385 Cong., 3rd Sess.), annexed hereto and marked "A");

(c) The reports published in House Document 1410, 62nd Congress, 3rd Session, upon a reexamination of New River from Radford, Virginia, to Hinton, W. Va., pursuant to River & Harbor Act approved July 25, 1912, the report of the Chief of Engineers stating "this whole section is unfavorable for navigation";

(d) Reports of District Engineer and endorsements thereon by Division Engineer, with reference to the present proposed project of New River Development Company. (The Company has not obtained copies of such reports but has been informed that their clear purport is that the river is not navigable in fact in Virginia.)

(e) Affidavits of persons authoritatively representing the interests of commerce on New River in Virginia and West Virginia attached hereto and marked "B."

2. That New River, i. e., above the Kanawha, has never been used or susceptible of use in interstate commerce of a substantial nature.

It is felt this finding is justified upon an examination of the War Department reports showing the nature of the improvement work attempted to be carried on from Hinton, W. Va., upstream. This improvement work never reached the Virginia line and several falls and rapids, Bulls, Wylie's, and Shumate's are mentioned as being impassable.

The commerce on New River referred to in the War Department Reports of 1882, as given in a table of railroad loadings and unloadings for the cities of Hinton, on the New River, and Lowell, on the Greenbrier, is apparently restricted to local commerce of river products. This is especially apparent from the table showing the extent and nature of commerce at Hinton in 1879, An. R., C. of E. 1880, pg. 681.

Paragraph 9 of the report of Major F. W. Alstaetter to the Chief of Engineers, dated November 21, 1912 (House Doc. 1410, 62nd Cong., 3rd Sess., p. 6), shows clearly the nature of the commerce as being local and insignificant.

See also affidavits annexed, marked "B."

3386 3. The head of recognized navigation is on the Kanawha, at Deepwater near Loup Shoals, some six miles below Kanawha Falls.

Reference is made to the reports of the War Department upon the operation of the locks and dams on the Kanawha River over a series of years, e. g., An. Rept., C. of E. 1923, p. 1252.

4. That federal improvements on New River, if deemed important, be treated separately from the question of navigability in fact and referred to for such importance as the Commission may

attach thereto; if mention be made of the improvements it is respectfully requested that a statement be made of the results accomplished by the improvements, the War Department's recommendations and attitude with respect thereto and the repeal of the provisions for the prosecution of the work, with the result that the work is no longer considered by the War Department as an authorized project for improvement.

In this connection reference is made to:

Reports referred to under "A 1 (a)" above;

Reports contained in House Document 1410, 62nd Cong., 3rd Sess.;

Sec. 7, River and Harbor Act of June 13, 1902;

Sec. 4, River and Harbor Act of August 8, 1917.

(The question of navigability based upon authorization by Congress for improvement has been taken up with the Power Commission and their Counsel. We feel that this question may satisfactorily be disposed of by the repeal of the provisions for prosecution of the work when no substantial results in creating actual navigability had been attained—aside from the fact, as we believe, that such a basis of navigability would constitute an unconstitutional basis of federal jurisdiction to compel a declarant to obtain a license and is not supported by the express terms of the Federal Water Power Act. In case a detailed exposition of our position in such matter is of interest a copy of a memorandum heretofore filed with the Commission is appended, marked "X" and attention is respectfully invited to section C thereof, pages 38 to 50 and section D, pages 51 to 72, inclusive.)

3387 B. As to effect of the proposed project upon navigable capacity of the Kanawha river:

That the effect of the proposed project of New River Development Company, located 155 miles by river above the head of recognized navigation, will, in general, be beneficial and it is not probable that there will be any substantial adverse effect upon the interest of interstate or foreign commerce.

Reference is made to:

(a) Endorsement by Colonel Kutz, Division Engineer, dated June 18, 1925, upon the report of Major H. M. Trippe, District Engineer, upon the proposed project.

(b) Letter of H. W. Buck, Esq., Engineer, Vice-President of Viele, Blackwell & Buck, to Hon. O. C. Merrill, Executive Secretary of Federal Power Commission, dated October 19, 1925, signed copy of which is attached hereto, marked "C".

Respectfully submitted.

CURTIS, MALLET-PREVOST, COLT & MOSLE.

3388

*Government exhibit No. 106–C*

1925, Oct. 1, 1925—"Supplemented Memorandum re Declaration of Intention of New River Development Co. (Original Exhibit.)

*Government exhibit No. 107*

1926, Feb. 20—Letter from Mr. Merriil, Executive Secretary, to Bascom Slemp giving notification of public hearing of March 2, 1926. (Original Exhibit.)

*Government exhibit No. 108*

1930, Oct. 16—Letter from C. M. P. C. M. to Federal Power Commission enclosing new drawings for minor part license to be substituted for certain drawings filed with original application for license. (Original Exhibit.)

*Government exhibit No. 109*

1926, April 15—Charge sheet pertaining to removal of General Taylor's report dated December 29, 1925, from files of F. P. C. (Original Exhibit.)

*Government exhibit No. 110*

"Record of the daily gage readings at Lock No. 24, Ohio River." (Original Exhibit.)

*Government exhibit No. 111*

"Record of daily gage readings at Lock No. 25, Ohio River. (Original Exhibit.)

*Government exhibit No. 112*

4 sheets being "gage readings of Locks Nos. 2, 3, and 4, Kanawha River, and Locks Nos. 26, 27, and 28, Ohio River, during low water periods of 1921, 1925, 1930, and 1932. (Original Exhibit.)

*Government exhibit No. 113*

Diagram showing hydrographs at gaging stations (Kanawha and New Rivers) with published mean daily flows July and August, 1932. Prepared U. S. Engineers Office, Huntington, W. Va. Sept. 1935. (Original Exhibit.)

3389 *Government exhibit No. 114*

1930, July and August—Diagram showing hydrographs at gaging stations (Kanawha & New Rivers) for July and August, 1930. Prepared U. S. Engineer Office, Huntington, W. Va., Sept. 1935. (Original Exhibit.)

*Government exhibit No. 115*

1936, Jan.—Diagram. Kanawha & New Rivers, Discharge at gaging stations. Data compiled from Automatic Water Stage Recorder. U. S. Engineer Office, Huntington, W. Va., Jan. 1936. (Original Exhibit.)

*Government exhibit No. 116*

1936, July 7.—Diagram. "Kanawha River Profile—Backwater studies. U. S. Engineer Office. Huntington, W. Va." (Original Exhibit.)

*Government exhibit No. 117–A*

1936, July 9—Diagram. "Rating Curves—Kanawha River, Lock No. 2, Mile 84.8; London Dam, Mile 82.81; and Lock No. 3, Mile 79.7. U. S. Engineer Office, Huntington, W. Va." (Original Exhibit.)

*Government exhibit No. 117–B*

1935, Dec. 10—Diagram. "U. S. Engineer Office, Huntington, W. Va., Rating Curves, Kanawah River, Locks Nos. 4 & 5, and Marmet." (Original Exhibit.)

*Government exhibit No. 117–C*

1935, Dec. 5—Diagram. "Rating Curves, Kanawha River, Locks Nos. 6, 7, 8." (Original Exhibit.)

*Government exhibit No. 117–D*

1936, July 8—Diagram. "Kanawha River—Rating Curves, Locks No. 9 and Winfield. U. S. Engineer Office, Huntington, W. Va." (Original Exhibit.)

*Government exhibit No. 117–E*

1935, Dec. 5—Diagram. "Rating Curves, Kanawha River, Locks Nos. 10 and 11." (Original Exhibit.)

3390 *Government exhibit No. 117–F*

1935, Dec. 10—Diagram, "Rating Curves, Ohio River below Point Pleasant at Lock No. 26. U. S. Engineer Office, Huntington, W. Va." (Original Exhibit.)

*Government exhibit No. 118*

1935, Dec.—Diagram. "Kanawha River Profile, Six & Nine feet projects." U. S. Engineer Office, Huntington, W. Va. (Original Exhibit.)

*Government exhibit No. 119*

1935, Dec.—Diagram. "Kanawha River and Tributaries, proposed improvements." U. S. Engineer Office, Huntington, W. Va. (Original Exhibit.)

*Government exhibit No. 120*

1935, Dec.—Diagram. "Kanawha River and Tributaries, Proposed improvements, profiles." U. S. Engineer Office, Huntington, W. Va. (Original Exhibit.)

*Government exhibit No. 121*

July 4–21, 1936—Gage recorder chart for New River at Eggleston, Va. (Original Exhibit.)

*Government exhibit No. 122*

July 6–21, 1936—Gage recorder chart for New River at Hinton (Packs Ferry), W. Va. (Original Exhibit.)

*Government exhibit No. 123*

1919, Aug. 29—Request for permit for repairs and replacements by Electro Metallurgical Company with following enclosures: (1) 1919, Aug. 29; Letter from W. J. Knapp, V–P, Electro-Met. Co. to Secretary of War. (2) 1919, Sept. 15 and 17; 1st and 2nd Endorsements by Howell and Beach, C. of E. (3) 1919, Sept. 27; 3rd End. by Pillsbury, C. of E. (4) 1919, Oct. 4; 4th End. by Howell, C. of E. (5) Plan of proposed location of replacement dam. (6) 1899, Mar. 2; Letter from Chief of Engineers Office to Major Bixby, C. of E., enclosing permit. (7) 1899, Feb. 27—Permit to Wilson Aluminum Co. (Original Exhibit.)

3391 *Government exhibit No. 123-A*

1934, Oct. 24—Copies of correspondence and reports relating to the Kanawha Falls Plant of Elec-Met. Co. as follows: (1) 1934, Oct. 24; Letter from Capt. Clay, C. of E. to McNinch, Chairman, F. P. C. enclosing the following: (2) 1898, Nov. 12; Letter from Wilson Aluminum Co. to Secretary of War. (3) Part of hand-written letter to Brig. Gen'l John M. Wilson, Chief of Eng. dated January 26, 1899. (4) War Department memorandum. (5) 1899, Feb. 13; Letter from Major Bixby to Brig. Gen. John M. Wilson, Chief of Eng. (6) War Department memo. (7) 3 endorsements by War Department. (8) Copy of telegram dated Feb. 17, 1899, from Mr. Wilson, Chief of Engineers to Wilson Aluminum Co. (9) Letter dated Feb. 18, 1894, from Wilson Aluminum Co. to Mr. Wilson, Chief of Engineers. (10) Letter from Sec. of War, Feb. 27, 1899, to Wilson Alum. Co. (Original Exhibit.)

3392 *Government exhibit No. 124*

1926, Nov. 30—Protest of Great Kanawha River Imp. Ass'n to H. M. Trippe.

3393 *Government exhibit 124*

GREAT KANAWHA RIVER IMPROVEMENT ASSOCIATION

Representing River Shipping Via Great Kanawha and Ohio Rivers

J. T. Hatfield, President; R. P. Gillham, Vice-President; F. W. Leahy, Secretary; Ed. F. J. Bramlage, Treasurer.

Executive Committee: J. T. Hatfield, Chairman; F. W. Leahy, Cincinnati, O.; Ed. F. J. Bramlage, Covington, Ky.; E. M. Merrill, Charleston, W. Va.; Otto Reemelin, Raymond City, W. Va.; R. J. Heslop, Pt. Pleasant, W. Va.

918 UNION CENTRAL BLDG.,
*Cincinnati, Ohio, November 30th, 1926.*

Major H. M. TRIPPE, U. S. A.,
*District Engineer, Huntington, W. Va.*

SIR: In the interest of the shippers and users of the Great Kanawha River and the public served by and through them, we protest the action of the Appalachian Power Co. in filing with your office, application for permission to construct and operate one or more hydroelectric dams on the New River, and we strongly oppose the granting of such permission unless we are

definitely and satisfactorily assured that the operation of such dam or dams will under the administration, control and direc supervision of the War Department.

It is our understanding that the Appalachian Power Co. hav made application to your Office for permission to construct an operate a hydroelectric dam, at or near Radford, on the New River in the state of Virginia and that the proposed dam will b approximately 110 feet in height and will impound sufficien water to cover an area of more than 19 square miles.

It is further understood that a steam generating plant is to b constructed to carry the normal electric load and that a hydro electric plant is to be constructed to carry the peak load. If ou assumption is correct, we do not believe that this plan of opera tion will materially vary the pool level and the flow into th Great Kanawha River but in the event of the steam plant being placed out of commission through a break-down or other causes we have no assurance that the hydro electric plant will not b forced to carry the entire load during the 24 hour period, unti the steam plant is again in service and should this occur during the period of low water, the natural result would be the lowering of the pool; and to be prepared for another emergency, it is ex pected that the pool would be re-filled with all dispatch, with th result that the normal flow would be shut off from the lower river which would prove disastrous to navigation on the Grea Kanawha River.

The Hydroelectric operators have nothing in common with th Great Kanawha River operators and shippers and it is natural t assume that they would look to their own interests first.

For the protection of the capital now invested in plant and equipment on and along the Great Kanawha River and to safe- guard future navigation upon this river it is imperative that the natural flow of the river to the head of navigation be unrestricted and the impoundment of the water in the Great Kanawha River

or its tributaries which will in any way cause a less flow
3394 or a fluctuating flow condition will be unalterably opposed by this Association.

We further protest the awarding of a construction per- mit to the Appalachian Power Co. until such time as the U. S. Engineer Department have determined by survey, that the fluc- tuating flow or wave effect caused by the water discharge at the dam will not interfere either with navigation or the operation of the locks and dams on the Great Kanawha River.

It is our understanding that a recent but incomplete survey made by your office has proven that the wave effect made by the

hydroelectric dam at Ivanhoe, Va., has been observed as far down the Great Kanawha River as Kanawha Falls, or at the headwaters of Navigation, and if such is the case, we are quite confident that the wave effect from the proposed dam at Radford will seriously affect both navigation and the operation of the movable dams in the upper Kanawha River. We base our opinion upon our understanding that the flow from the dam at Ivanhoe is approximately 2,500 second-feet and that the flow from the proposed dam will be approximately 6,000 second-feet.

As heretofore stated we wish to go on record with your office as opposed to the granting of any permit to the Appalachian Power Company or any other similar concern who contemplate the building of hydroelectric or other dams on either the Great Kanawha River or its tributaries that will in any way reduce or cause an intermittent flow in the Great Kanawha River that will affect navigation on said river.

We do not oppose the construction of any dam or dams providing the construction and operation of such dam or dams are under the supervision of the U. S. Engineer Department and that we receive satisfactory assurance from the said United States Engineer Department that the operation of such dam or dams will not be to the detriment of navigation or to the improvement of the great Kanawha River.

Very truly yours,

THE GREAT KANAWHA RIVER IMPROVEMENT ASSN.
F. W. LEAHY, *Secretary.*

Approved:

——— ———, *President,*
——— ———, *Chairman, Hydroelectric Committee.*

3395 *Government Exhibit No. 125*

1926, Nov.—Protest of Public Service Commission of W. Va.

3396 Project No. 739. In the matter of The Application of Appalachian Electric Power Company, a Virginia corporation, to Federal Power Commission for a License, Project No. 739, with respect to water power development on the New River at a point approximately one mile above the mouth of Little River and seven miles above the City of Radford, Virginia, upon which application a public hearing has been advertised to be held in the County Court Room, at the City of Radford, Virginia, on Thursday, October 28, 1926, at 1:00 P. M.

The Public Service Commission, of West Virginia, represents that the above mentioned project is proposed to be located on the New River, near Radford, Virginia; that the New River flows into the State of West Virginia and is tributary to the Kanawha River, which flows through the State of West Virginia and empties into the Ohio River at Point Pleasant, West Virginia; that there is now located and operated on the Kanawha River, at Glen Ferris, West Virginia, a short distance below the mouth of New River, a dam for hydroelectrical development, the power from which is used in industrial works at that point; that the New River and Kanawha River within the State of West Virginia, by reason of topography of the country traversed and other factors,
3397 are capable of producing a very large amount of water power; and that the Kanawha River is navigable below Montgomery, West Virginia.

That it has been represented to this Commission that the dam for water storage and water power development proposed in the application of the Appalachian Electric Power Company, Project No. 739, has the possibility of greatly benefiting and also greatly damaging present or potential water power developments, as well as navigation on the navigable portions, of the New River and Kanawha River, within the State of West Virginia, depending upon the manner in which and the extent to which the natural flow of the stream may be modified through the impounding of water by such dam and its release therefrom. This Commission, therefore, represents that the present and future water power development of the New River and the Kanawha River within the State of West Virginia may be harmfully affected by the operation of the project set forth in the application of the said Appalachian Electric Power Company, Project No. 739.

The Public Service Commission, of West Virginia, on behalf of the State of West Virginia, the citizens of said state, and especially those industries and individuals enjoying riparian rights and privileges on the New River and the Kanawha River, within the said state, hereby protests against th granting by the Federal Power Commission to the said Appalachian Electric Power Company of the license applied for in its said application, or
3398 any amendment thereof, or substitute thereof, unless such license shall contain as a condition thereof, a provision to the effect that no interference shall be permitted to be made in the flow past such dam as shall be authorized or constructed in pursuance of such license, that may at any time restrict the natural flow of the said river, or the continuous use thereof for power purposes or navigation at points downstream from such dam and within the State of West Virginia, in such manner that there

would be through the operation of such dam or project, any diminution of the flow of said river, (1) either below the natural flow of the said river whenever its natural discharge is less than its mean natural discharge, or (2) below the mean natural discharge of the said river whenever its natural discharge exceeds its mean natural discharge.

Respectfully submitted.

PUBLIC SERVICE COMMISSION OF WEST VIRGINIA,
By (Signed) ——— ———, *Attorney.*
Dated November 3, 1926.

3399 *Government exhibit No. 126*

1925, May 28—Letter C. B. Slemp to General Taylor re letter from Mr. Buck.

3400 LAW OFFICES OF GOOD, CHILDS, BOBB & WESCOTT
Illinois Merchants Bank Building
231 South LaSalle Street, Chicago

James W. Good, Robert W. Childs, Dwight S. Bobb, James B. Wescott, C. Bascom Slemp, George B. McKibbin, William A. Bradford, Walter E. Beebe, Francis L. Harris, Esther A. Dunshee, F. M. Hartman, George D. Mills, I. L. Smith.

Washington office—C. Bascom Slemp, 818 Fifteenth St., NW., Washington, D. C.

WASHINGTON, D. C., *May 28, 1925.*

Major General H. TAYLOR,
*War Department, Washington, D. C.*

DEAR GENERAL TAYLOR: I am sending herewith letter from Mr. Buck which is in accordance with our conversation recently.

We will be glad to furnish any further information desired at any time.

Thanking you for your kindness and courtesy in the matter, I am,

Very truly yours,

(Signed) C. B. SLEMP,
C. B. Slemp.

3401 *Government exhibit No. 126-A*

1925, May 27—Letter Mr. Buck, of V. B. & B., to General Taylor, C. of E.

3402 F. O. Blackwell
H. W. Buck

Telephone
Hanover 2142

VIELE, BLACKWELL & BUCK, ENGINEERS

49 Wall Street, New York

Cable Address: Hyroelec, New York

MAY 27, 1925.

Major General HARRY TAYLOR,
*Chief of Engineers, War Department, Washington, D. C.*

DEAR SIR: Supplementing our discussion in Washington on Monday on the subject of proposed dam on New River in Virginia I am sending you herewith at your request some further data in relation thereto.

Location: On New River in the State of Virginia near Radford at a point 4,970 feet above mouth of Little River.

Height of dam: Approximately 115 feet.

Installed capacity: 75,000 H. P.

Drainage area: At dam site 2,396 square miles. At head of navigation Kanawha River 8,470 square miles.

Distance above navigation: 155 miles via River.

3403 Elevation of river at dam site: 1,730 feet.

Elevation of river at head of navigation: 650 feet.

Storage above dam: 40,000 acre feet with 10′ draft of water.

It is the desire of the New River Development Company to construct this dam and hydroelectric development at once and to comply with the requirements of the War Department in respect to navigation on New River, if affected.

New River at the site of the proposed dam is not navigable in fact. The location is so far in elevation above the navigable portion of the river (Kanawha) 1080′ that the extension of navigation up to the proposed dam site would be an expensive proposition.

We believe that any fluctuations in discharge of water at the dam due to ordinary load variations would be entirely absorbed by the numerous pools which exist in the River in the 155 miles of river between the dam and the head of navigation and would not affect navigation in any way. 75% of the flow in the Kanawha River, which is the navigable portion of New River, enters the river below the proposed dam. Furthermore the Kanawha is a completely canalized river and the water levels upon which

3404 navigation is dependent therein are fixed by lock levels and back water from the Ohio and are more or less independent of flow in river above provided there is sufficient flow at all times to operate locks and supply lock and dam leakage.

The storage above the proposed dam will be sufficient when utilized during the low flow in the River to increase the mini-

mum flow at the dam site by approximately 500 cubic feet per second in an average year. It will also serve to retard and reduce floods in the River below and to average the monthly flows. All of this will be for the benefit of the River below the dam.

We are enclosing herewith the following blueprints:

A–6836—Map showing general location of proposed dam.

R–7652—Showing storage reservoir above dam.

R–7656—Showing general plan of proposed development.

I hope the above information will be sufficient for your purpose and for Major Trippe at this time.

Very truly yours,

VIELE, BLACKWELL & BUCK,
By s/ H. W. Buck
*Engineers for New River Development Company.*

HWB/M.

3405 *Government exhibit No. 126–B*

Map. New River Development Co.—preliminary layout. Damsite above mouth of Little River.

3407 *Government exhibit No. 127*

1925, June 1—First Endorsement General Jadnin (C. of E.) to District Engineer, re Buck letter 5/27/25.

3408 7495 (New River Development Co.)—1.
Subject: Project on New River, Va.

1st Ind.

Office, C. of E., June 1, 1925.—To the District Engineer, U. S. Engineer Office, Huntington, W. Va.

It is requested that the District Engineer submit report as to what effect, if any, the power development discussed in the inclosed communication will have on the navigability of the New River and its effluents, and whether, in his opinion, there is any objection to the construction of the project without Federal jurisdiction.

By order of the Chief of Engineers:

(Signed) EDGAR JADWIN.
Edgar Jadwin,
*Brig. Gen., C. of E.,*
*Assistant Chief of Engineers.*
per JROM.

4 incls., viz: Sub. 1—Viele, Blackwell & Buck, 5/27/25. Subs. 2–4—Blueprints.

8409 *Government Exhibit No. 188*

1925, June 15—2nd End. Trippe to Chief of Engineers (Project on New River).

3410 7495 (New River Development Co.)—1.
Subject: Project on New River, Va. M668/1

2nd Ind.

U. S. Engr. Office, Huntington, W. Va., June 15, 1925.—To the Chief of Engineers, U. S. A. (through the Division Engineer, Central Division).

1. As requested in letter of June 10, 1925, O. C. of E. file 7495 (New River Development Co.)—1, a conference was held in this office on this date with a representative of the New River Development Co. who gave the following reasons for desiring to construct the proposed project without Federal jurisdiction:

The company desires to commence the construction as soon as possible and have an organization ready for the purpose.

Topographic surveys have been made, maps prepared and core drillings at the dam site are now under way.

Hydrographic data has been collected and gaging station has been established at the dam site.

Necessary land at the site has been acquired and have also purchased some land and acquired options on other tracts for the remaining land necessary.

Have plans in preparation and well under way for the powerhouse and other structures.

2. In view of the proposed increase by the construction of this power project of approximately 500 second feet of the low-water flow of the New River the proposed project would in no way interfere with navigation on the Kanawha River which is formed by the junction of the New and the Gauley Rivers and which is canalized for the greater part of its length by the construction of locks and dams. The said project would on the other hand be a benefit to navigation on the Kanawha River if the low-water flow be augmented as propcsed.

3. As to the proposition of the New River Development Company that they be permitted to construct the proposed development without Federal jurisdiction, it is not seen how this can be permitted for two reasons: first, the New River while not navigable in fact is legally a navigable stream, the Government in the past having expended moneys on this stream for channel improvement; second, because of the fact as previously stated that the New River is considered a navigable stream it would be inconsistent with the policy that has prevailed in the past to require power developments on this stream to be under the

3411 jurisdiction of the Federal Power Commission and now permit the project here under consideration to be constructed without such jurisdiction. The following proposed developments for water power on the New River have been projected since the enactment of the Federal Water Power law and have been considered as coming within the jurisdiction of the Federal Power Commission:

Project No. 223—West Virginia. Preliminary permit granted to Charles B. Hawley, Washington, D. C., for power development at Sandstone Falls. This permit expired November 5, 1924.

Project No. 379—West Virginia and Virginia. Preliminary permit granted to the West Virginia Power Company, Charleston, W. Va., for power development at the mouth of the Bluestone River. This permit is still in force.

Project No. 542—North Carolina. Application submitted and pending for preliminary permit for power development on the New and Reddies River in North Carolina.

Project No. 575—Virginia and North Carolina. Application submitted and pending by the Eastern States Development Company, Wheeling, W. Va., for power development on the New River in Virginia and the Fisher River in North Carolina.

4. It is, therefore, the opinion of this office that the proposed water-power project of the New River Development Company will be no obstruction to navigation but rather a benefit provided the low-water flow of the river be augmented as proposed and that there is no objection to proposed development from the standpoint of its influence on navigation.

5. In view of the past policy of considering the New River a navigable stream and of the fact that four previous applications for water-power development on this stream have been considered as coming under the jurisdiction of the Federal Power Commission it is not seen how the New River Development Company can consistently be permitted to construct their proposed project without Federal jurisdiction unless the stream now be declared not navigable and Federal jurisdiction over the four previously proposed water-power projects be cancelled and all applicants for such developments be placed on the same basis.

(Signed) H. M. TRIPPE,
H. M. Trippe,
*Major, Corps of Engineers,*
*District Engineer.*

4 inclosures: Sub. 1—Viele, Blackwell & Buck, 5/27/25. Subs. 2-4—Blueprints.

3412 *Government exhibit No. 129*

1925, June 18—3rd End. Col. Kutz to Chief of Engineers (Project on New River).

3413 7495 (New River Development Co.)—1.
Subject: Project on New River, Va.

3rd Ind.

CWK/a

Office Div. Engr., Cent. Div., June 18, 1925.—To the Chief of Engineers.

1. The effect of the proposed power development upon the navigability of New River and its effluents would be beneficial below the dam, and above the dam the river is apparently not navigable in fact.

2. The work heretofore done on New River, together with the improvements recommended but not actually undertaken, seem to bring this stream clearly under the jurisdiction of the Federal Power Commission. Considered only with respect to its influence on navigation, there is no objection to the construction of the project without Federal jurisdiction.

(Signed) C. W. KUTZ,
C. W. Kutz,
*Col., Corps of Engineers,*
*Division Engineer.*

4 incls.: Sub. 1—Letter, 5/27/25. Subs 2-4—Blueprints.

3414 *Government exhibit No. 130*

JULY 1, 1927.

MESSRS. CURTIS, MALLET-PREVOST, COLT & MOSLE,
*30 Broad Street, New York, N. Y.*

GENTLEMEN: There are enclosed duplicate copies of the license which it is proposed to issue to the Appalachian Electric Power Company for a power project in the New River near Radford, Pulaski County, Virginia.

If the instruments are satisfactory, it is requested that both copies be signed and returned together with two certified copies of the resolution of the board of directors authorizing acceptance.

The Commission has not yet authorized the granting of this license, but it is expected that such authorization will be given at a future meeting, and in order to expedite matters the drafts are being sent you in advance for acceptance. As soon as the Commission has acted favorably and the accepted drafts have been re-

turned both copies will be executed and the original will be forwarded for the files of the licensee.

A certified copy of that part of the minutes of the Commission's meeting on June 1, showing the action taken on the declaration of intention of the New River Development Company, is enclosed for your information.

It is understood that the company is contemplating modifying its plans. It is requested that with the acceptance of the license it submit the new plans so that they may be approved by the Chief of Engineers and the Secretary of War. The license will then be modified where necessary in order to site the new exhibits.

Very truly yours,

O. C. MERRILL,
*Executive Secretary.*

NBK*TL.
4 copies to C. of E.; 1 to Viele, Blackwell & Buck.

3414–A THE FEDERAL POWER COMMISSION

License on Navigable Waters—Project No. 739—Virginia

APPALACHIAN ELECTRIC POWER COMPANY

Whereas, by Act of Congress, approved June 10, 1920 (41 Stat., 1063) designated therein as "The Federal Water Power Act" and hereinafter called "the Act," the Federal Power Commission, hereinafter called "the Commission," is authorized and empowered, inter alia, to issue licenses for the purpose of constructing, operating, and maintaining dams, water conduits, reservoirs, power houses, transmission lines, or other project works necessary or convenient for the development, transmission and utilization of power across, along, from or in any of the navigable waters of the United States, or upon any part of the public lands and reservations of the United States (including the Territories), or for the purpose of utilizing the surplus water or water power from any Government dam; and

Whereas, Appalachian Electric Power Company, hereinafter called "the Licensee," a corporation organized and existing under the laws of the State of Virginia and having its office and principal place of business in the city of Richmond in the State
3414–B of Virginia has made application in due and proper form to the Commission for a license for a power project designated as Project No. 739 on the records of the Commission, and for authority to construct, maintain and operate, in the New River, in the vicinity of Radford, in the County of Pulaski, State of Virginia, certain project works, as hereinafter described, neces-

sary or convenient for the development and improvement of navigation and for the development, transmission and utilization of power; and

Whereas, the Commission on the 1st day of June 1927 found that the interests of interstate and foreign commerce would be affected by the proposed development; and

Whereas, the Licensee has submitted to the Commission satisfactory evidence of its compliance with the laws of the State of Virginia as required by Section 9, subsection (b) of the Act, and the Commission is satisfied as to the ability of the Licensee to carry out the plans for said project as filed with said application; and

Whereas, notice of said application has been given and published by the Commission, as required by Section 4 of the Act; full opportunity has been given to all interested parties to be heard, and no application for said project, or in conflict therewith, has been filed by any State or municipality; and

Whereas, the maps, plans and specifications of said project and of said project works, as hereinafter described, have been approved by the Commission, and the plans of the dam and other structures affecting navigation have been approved by the Chief of Engineers and the Secretary of War; and

Whereas, the Commission has found that said project, as hereinafter described, will be best adapted to a comprehensive scheme of improvement and utilization of said waterway for the purposes of navigation, of water power development and other beneficial public uses; and

Whereas, the Commission did on the day of find that the contemplated improvement is desirable and
3414-C justified in the public interest for the purpose of improving or developing a waterway, namely, the Kanawha River, for the use or benefit of interstate and foreign commerce, a certified copy of the records of the Commission containing such finding being hereto attached; and

Whereas, the Licensee, on the day of pursuant to an authorization of its board of directors, a copy of the record thereof being hereto attached, accepted in writing all the terms and conditions of the Act and of this License;

Now, therefore, the Commission hereby issues this License to the Licensee for the purpose of constructing, operating and maintaining certain project works necessary or convenient for the development and improvement of navigation and for the development, transmission and utilization of power across, along, from or in said New River, and constituting a part of the project hereinafter described; said license, including the period thereof, being

subject to all the terms and conditions of the Act and of the rules and regulations of the Commission pursuant thereto as amended and made effective on the first day of April, 1924, as though fully set forth herein, which said rules and regulations are attached hereto and made a part hereof, and being subject also to the following express conditions and limitations, to wit:

ARTICLE 1. This license is issued for a period of fifty (50) years from the date hereof, and in consideration of such license and the benefits and advantages accruing thereunder to the Licensee it is expressly agreed by the Licensee that the entire project, project area and project works as hereinafter designated and described, whether or not located in, on or along said New River or upon lands of the United States, shall be subject to all the terms and conditions of this license, including the terms and conditions of the Act and of the rules and regulations of the Commission pursuant thereto and made a part of this license.

ARTICLE 2. The project covered by and subject to this license consists of—

3414–D A. All lands constituting project area and inclosed, or the location of which is shown, by the project boundary, and/or interests in such lands necessary or useful for the purposes of the project, whether such lands or interests therein are owned or held by the Licensee or by the United States; such project area and project boundary being more fully shown and described by certain exhibits which accompanied said application for license and which are designated and described as follows:

Exhibit J—In one sheet with title "Development No. 6 above Little River, Virginia, Location Map and Drainage Area."

Exhibit K—In one sheet with title "Development No. 6 Above Little River, Virginia, Map Showing Project Boundary."

Each exhibit signed on August 30, 1926 by N. M. Argabrite, Vice President, Appalachian Electric Power Company.

B. All project works consisting of a concrete dam, an auxiliary earth dam, and a power house with appurtenant structures and equipment; the location, nature, and character of which project works are more fully shown and described by certain exhibits which accompanied said application for license and which are designated and described as follows:

Exhibit L—In two sheets with titles "Preliminary Layout Development No. 6, Dam Site Above Little River, Virginia" and "Preliminary Layout Development No. 6, Flood Gates."

Exhibit M—One typewritten sheet briefly describing the mechanical and electrical equipment.

Each exhibit signed on August 30, 1926 by N. M. Argabrite, Vice President, Appalachian Electric Power Company.

D. All other structures, fixtures, equipment, or facilities used or useful in the maintenance and operation of the project
3414-E and located upon the project area, including such portable property as may be used and useful in connection with the project or any part thereof, whether located on or off the project area, if and to the extent that the inclusion of such property as a part of the project works is approved or acquiesced in by the Commission; also all other rights, easements, or interests the ownership, use, occupancy or possession of which is necessary or appropriate in the maintenance and operation of the project or appurtenant to the project area.

ARTICLE 3. The maps, plans, specifications, and statements designated and described in Article 2 hereof as Exhibits J, K, L and M respectively, and approved by the Executive Secretary for the Commission in accordance with its authorization of , are hereby made a part of this license, and no substantial change shall hereafter be made in said exhibits, or any of them, until such change shall have been approved by the Commission: Provided, however, that if the Licensee deems it necessary or desirable that said approved maps, plans, specifications and statements, or any of them, be changed there shall be submitted to the Commission for approval amended, supplemental, or additional maps, plans, specifications and statements covering the proposed changes, and upon approval by the Commission of such proposed changes such amended supplemental or additional maps, plans, specifications, and statements shall become a part of this license and shall supersede, in whole or in part, such map, plan, specification, or statement, or part thereof, theretofore made a part of this license as may be specified, respectively, in the order or endorsement of approval.

ARTICLE 4. Said project works shall be constructed in substantial conformity with the approved maps, plans and specifications thereof made a part of this license and designated and described in Articles 2 and 3 hereof or as changed in accordance with the provisions of said Article 3. Except when emergency shall require for the protection of navigation, life, health, or property, no substantial alteration or addition not in conformity with the approved plans shall be made to any dam or other project works constructed under this license without the prior approval of the Commission; and any emergency alter-
3414-F ation or addition so made shall thereafter be subject to such modification and change as the Commission shall direct. Minor changes in or divergence from such approved maps, plans, and specifications may be made in the course of construction, if such changes will not result in decrease in efficiency, in material

increase in cost, or in impairment of the general scheme of development; but any such minor changes made without the prior approval of the Commission which in its judgment have produced or will produce any of such results shall be subject to such alteration as the Commission may direct.

ARTICLE 5. The work of construction under this license, whether or not conducted upon lands of the United States, shall be subject to the inspection and approval of the District Engineer, U. S. Engineer Office, Huntington, W. Va., or of such other officer or agent as the Commission may designate, who shall be the authorized representative of the Commission for such purposes. The Licensee shall notify such representative of the date upon which work will begin, and as far in advance thereof as said representative may reasonably specify, and shall notify him promptly in writing of any suspension of construction for a period of more than one week, and of its resumption and completion.

ARTICLE 6. Subject to the provision of Section 13 of the Act, the Licensee shall begin the construction of said project works within one year after date of issuance of this licensee, shall thereafter in good faith and with due diligence prosecute such construction, and shall complete the same within four years from said date.

ARTICLE 7. Upon the completion of the project works, or at such other time as the Commission may direct, the Licensee shall submit to the Commission for approval revised maps, plans, specifications, and statements, in so far as necessary to show any divergence from or variations in the project area as finally located or in the project works as constructed when compared with the area shown and the works designated or described in this license or in the maps, plans, specifications, and statements approved by the Commission under the provisions of Article 3 hereof, together with a statement in writing setting forth the reasons which in the opinion of the Licensee necessitated or justified vari-
3414-G ations in or divergence from the approved maps, plans, specifications, and statements. Such revised maps, plans, specifications, and statements shall, if and when approved by the Commission, be made a part of this license and shall, to the extent and in the particulars set forth in the order or endorsement of approval, be substituted for the maps, plans, specifications and statements theretofore approved by the Commission under the provisions of Article 3 hereof. The maps finally approved by the Commission and made a part of this license under the provisions of Article 3 and/or 7 hereof shall show the project area to an adequate scale and the boundary thereof either by legal subdivisions, by metes and bounds survey, or by uniform

offsets from center-line survey. Said project area shall include all lands without respect to ownership and whether or not the exact boundaries can be definitely fixed and determined, the use and occupancy of which are or will be valuable or serviceable in the maintenance and operation of the project; on which are located or to which are appurtenant the project works (other than portable property) and the rights, easements, or interests likewise valuable and serviceable; and the ownership or possession, or the right of use and occupancy, of which are subject to acquisition by the United States under the provisions of Section 14 of the Act. Said maps shall show the ownership of each parcel of land in said project area, and with respect to each parcel to which the Licensee has not the fee title, the character of the right of use and occupancy possessed by the Licensee together with the term of such right.

ARTICLE 8. In so far as any material is dredged or excavated in the prosecution of the work herein authorized, it shall be removed and deposited so it will not interfere with navigation and to the satisfaction of said District Engineer.

ARTICLE 9. For the purpose of determining the stage and flow of the stream or streams from which water is to be diverted for the operation of said project works and of the amount of water held in and drawn from storage, the Licensee shall install and thereafter maintain such stream gages and stream gaging stations as may be necessary to determine the flow of the New River available to the project, a standard gage in the reservoir above the dam and an automatic recording gage in the stream below the tailrace of the power plant, and shall provide for the required readings of such gages and for the adequate rating of said station or stations. The Licensee shall also install and maintain standard meters adequate for the determination of the amount of electric energy generated by said project works. The number, character, and location of gages, meters or other measuring devices, and the method of operation thereof may be altered from time to time if necessary to secure adequate determinations, but such alteration shall not be made except with the approval of the Commission or its authorized representative or upon the specific direction of the Commission. The installation of gages, the ratings of said stream or streams, and the determination of the flow thereof, shall be under the supervision of the District Engineer of the United States Geological Survey having charge of stream gaging operations in the region of said project, and the Licensee shall reimburse the said United States Geological Survey for costs incurred in such supervision or for such part thereof as said

3414–H

District Engineer may deem equitable in the circumstances. The Licensee shall keep accurate and sufficient record of the foregoing determinations to the satisfaction of the Commission, shall make return of such records annually at such time and in such form as the Commission may prescribe.

ARTICLE 10. The Licensee shall be liable for all damages occasioned to the property of others by the construction, maintenance or operation of said project works, or of the works appurtenant or accessory thereto, and in no event shall the United States be liable therefor.

ARTICLE 11. In the construction and maintenance of the project works herein specified, the Licensee shall place and maintain suitable structures to reduce to a reasonable degree the liability of contact between its transmission lines and telegraph, telephone and other signal wires or power transmission lines not owned by the Licensee, and shall also place and maintain suitable structures and devices to reduce to a reasonable degree the liability of any structures or wires falling and obstructing traffic and endangering life on highways, streets or railroads.

3414–I ARTICLE 12. The Licensee shall allow officers and employees of the United States free and unrestricted access in, through and across the said project and project works in the performance of their official duties.

ARTICLE 13. The operation of any navigation facilities which may be constructed as a part of or in connection with any dam or diversion structure built under the provisions of this license shall at all times be controlled by such reasonable rules and regulations in the interest of navigation, including the control of the level of the pool caused by such dam or diversion structure, as may be made from time to time by the Secretary of War. Such rules and regulations may include the maintenance and operation by the Licensee at its own expense of such lights and signals as may be directed by the Secretary of War, and such fishways as may be prescribed by the Secretary of Commerce.

ARTICLE 14. The United States specifically retains and safeguards the right to use water in such amount, to be determined by the Secretary of War, as may be necessary for the purposes of navigation, and the operations of the Licensee so far as they affect the use, storage, and discharge from storage of waters affected by this license, shall at all times be controlled by such reasonable rules and regulations as the Secretary of War may prescribe in the interests of navigation and as the Federal Power Commission may prescribe in the interests of flood control and of the fullest practicable use of said waters for power purposes; Provided, That the Licensee shall discharge at least 9,000 acre feet

of water per week over or through the dam, and whenever the flow at lock No. 2, Kanawha River, falls below 1,400 cubic feet per second the Licensee shall, unless otherwise authorized by the Secretary of War, discharge in each twenty-four hours the natural flow of the river entering the reservoir during the same period, such weekly and daily discharges being subject to the reasonable rules and regulations hereinbefore mentioned.

ARTICLE 15. Whenever the United States shall desire to construct, complete, or improve navigation facilities in connection with said project, the Licensee shall convey to the United 3414-J States, free of cost, such of its lands, and its rights of way, and such right of passage through its dam or other structures and permit such control of pools as may be required to complete such navigation facilities.

ARTICLE 16. The Licensee shall construct and install such appliances as are necessary for furnishing power for the operation of navigation facilities, including lights and signals, whether constructed by the Licensee or by the United States; and shall furnish, free of cost to the United States, power for the operation of such navigation facilities.

ARTICLE 17. The Licensee shall cut and remove or destroy to the satisfaction of the District Engineer all brush and trees from that zone within and adjacent to the area to be submerged which is included between the contour of elevation 1,830 feet above mean sea level and a line 15 feet horizontally outside of the contour of elevation 1,841 feet above mean sea level, and shall remove or destroy all floatable refuse or material within said areas to be submerged. The Licensee shall also cut in such manner or so remove or destroy brush and trees within said area to be submerged that no part of such brush and trees shall project above said elevation of 1,830 feet.

ARTICLE 18. The Licensee hereby agrees as a condition of this license that the amount to be entered upon the fixed capital accounts of said project and reported to the Commission as representing the actual legitimate cost thereof and the actual legitimate investment therein up to the date of this license, whether consisting of expenditures actually made, of charges accrued, or of liabilities or obligations incurred, shall be determined by the Commission in accordance with the provisions of the Act and of the regulations established thereunder; and it is further agreed by the Licensee that upon completion of the construction of said project or of any addition to or betterment of said project the Licensee shall file with the Commission a statement, under oath in duplicate, in such detail as the Commission may require, showing the actual legitimate cost of construction thereof, together with the

price paid for water rights, rights-of way, lands or inter-
3414–K est in lands constituting any part of the project property
subject to the provisions of this license, all as specified in regulation 20, section 2, of said rules and regulations. Such statement or statements shall include all proper and legitimate costs, whether incurred prior to the date of this license or on and after such date; and the licensee shall, if requested by the Commission, show separately on such statement or statements the items and amounts of cost incurred prior to the issuance of this license as determined by the Commission as hereinbefore in this article provided, with such other details with respect to the cost of the project or any part thereof as the Commission may require. Each and every item of cost included in such statements shall be supported by proper voucher or other record; and any such voucher or record, or certified copy thereof, in support of any item properly includible in said cost shall become a part of the permanent records of said project and shall be kept and retained by the Licensee in the manner required by the Commission.

ARTICLE 19. Whenever the Licensee is directly benefited by the construction work of another licensee, a permittee, or of the United States of a storage reservoir or other headwater improvement, the Licensee shall reimburse the owner of such reservoir or other improvement for such part of the annual charges for interest, maintenance and depreciation thereon as the Commission may deem equitable. The proportion of such charges to be paid by the Licensee shall be determined from time to time by the Commission. Whenever such reservoir or other improvement is constructed by the United States the Licensee shall pay similar charges into the Treasury of the United States upon bills rendered by the Commission.

ARTICLE 20. The Licensee shall pay to the United States reasonable annual charges for the purpose of reimbursing the United States for the costs of the administration of the Act and for recompensing it for the use, occupancy and enjoyment of its lands or other property hereinbefore described. The payment by the Licensee of such annual charges for any calendar year shall be made to the United States at the end of the year or
within thirty days thereafter, upon bills rendered or
3414–L approved by the Commission. Such charges shall be determined in accordance with the provisions of Regulation 14 of said rules and regulations of the Commission, and for the purposes of such determination the power capacity shall be taken as 12,100 horsepower.

ARTICLE 21. After the first twenty years of operation of said project under this license, out of surplus earned thereafter, if any,

accumulated in excess of a specified reasonable rate of return upon the actual, legitimate investment of the Licensee in said project, all as defined in and determined by the provisions of regulation 17 of said rules and regulations of the Commission, the Licensee shall establish and maintain amortization reserves, which reserves shall, in the discretion of the Commission, be held until the termination of the license or be applied from time to time in reduction of the net investment. Such specified rate of return shall, subject to the proviso of paragraph A, section 3 of said regulation, be one and one-half (1½) times the weighted average annual interest rate payable on the par value of the bona fide interest-bearing debt of the Licensee actually outstanding in whole or in part, on account of project property at the beginning of the period of amortization and of each calendar year thereafter; such weighted average annual interest rate being determined as provided in paragraphs B and C of section 3 of said regulation 17: Provided, That, if at the beginning of the period of amortization or of any calendar year thereafter, the outstanding interest-bearing debt of the Licensee on account of the project or projects under license, together with any other works or property operated in connection therewith, is less than 25 percent of the actual, legitimate investment of the Licensee in said project or projects, then and in such event for the calendar year next following the specified rate of return shall be two (2) times the legal rate of interest in the State in which the project or major part thereof is located.

Subject to the provisions of section 6 of said regulation, the following proportions of such surplus earnings shall be paid into and held in such amortization reserves: Of all surplus earnings up to and including 2 percent upon the actual, legitimate investment, 30 percent thereof shall be so paid; of all surplus earnings in excess of 2 percent and not in excess of 4 percent upon such investment, 50 percent thereof shall be so paid; of all surplus earnings in excess of 4 percent and not in excess of 6 percent, 70 percent thereof shall be so paid, and of all surplus earnings in excess of 6 percent, 90 percent thereof shall be so paid; Provided, That if at the end of any calendar year of the amortization period the Commission shall find that the accumulated earnings of the Licensee during the period of operation, including the first twenty (20) years thereof, have not yielded a fair return upon the actual, legitimate investment in the project or projects under license, the proportion of such surplus earnings for such calendar year and for succeeding calendar years to be paid into such amortization reserves shall be ten (10) percent thereof until such time as the accumulated earnings of the Licensee represent, in the judgment of the Commission, a fair return upon such investment for such period of operation.

ARTICLE 22. No lease of said project or part thereof whereby the lessee is granted the exclusive occupancy, possession or use of project works for purposes of generating, transmitting or distributing power shall be made without the prior written approval of the Commission; and the Commission may, if in its judgment the situation warrants, require that all the conditions of this license, of the Act, and of said rules and regulations of the Commission shall be applicable to such lease and to such property so leased to the same extent as if the lessee were the Licensee hereunder; Provided, That the provisions of this article shall not apply to parts of the project or project works which may be used by another jointly with the Licensee under a contract or agreement whereby the Licensee retains the occupancy, possession, and control of the property so used and receives adequate consideration for such joint use, or to leases of land while not required for purposes of generating, transmitting, or distributing power, or to buildings or other property not built or used for said purposes, or to minor parts of the project or project works the leasing of which will not interfere with the usefulness or efficient operation of the project by the Licensee for said purposes.

3414-N ARTICLE 23. It is hereby understood and agreed that the Licensee, its successors and assigns will, during the period of this license, retain the possession of all project property covered by this license as issued or as hereafter amended, including the project area, the project works, and all franchises, easements, water rights, and rights of occupancy and use; and that none of such properties valuable and serviceable to the project and to the development, transmission, and distribution of power therefrom will be voluntarily sold, transferred, abandoned, or otherwise disposed of without the approval of the Commission: Provided, That a mortgage or trust deed or judicial sales made thereunder, or tax sales, shall not be deemed voluntary transfers within the meaning of this article. The Licensee further agrees, on behalf of itself, its successors and assigns, that, in the event said project is taken over by the United States upon the termination of this license, as provided in Section 14 of the Act, or is transferred to a new Licensee under the provisions of Section 15 of the Act, it will be responsible for and will make good any defect of title to or of right of user in any such project property which is necessary or appropriate or valuable and serviceable in the maintenance and operation of the project, and will pay and discharge or will assume responsibility for payment and discharge of all liens or incumbrances upon said project or project property created by said Licensee or created or incurred after the issuance of this license: Provided, That the provisions of this article are not intended to

prevent the abandonment or the retirement from service of structures, equipment, or other project works in connection with replacements thereof when they become obsolete, inadequate, or inefficient for further service due to wear and tear, or to require the Licensee for the purpose of transferring the project to the United States or to a new Licensee to acquire any different title or right of user in any such project property than was necessary to acquire for its own purposes as Licensee.

ARTICLE 24. The Licensee shall abide by such reasonable regulation of the services to be rendered to customers or consumers of power, and of rates and charges of payment therefor, as may from time to time be prescribed by any duly constituted agency of the State in which the service is rendered or the rate charged; and in case of the development, transmission, distribution, sale or use of power in public service by the Licensee or by its customers engaged in public service within a State which has not authorized and empowered a commission or other agency or agencies within said State to regulate and control the services to be rendered by the Licensee or by its customers engaged in public service, or the rates and charges of payment therefor, or the amount or character of securities to be issued by any of said parties, it is agreed as a condition of this license that jurisdiction is hereby conferred upon the Commission, upon complaint of any person aggrieved or upon its own initiative, to exercise such regulation and control until such time as the State shall have provided a commission or other authority for such regulation and control: Provided, That the jurisdiction of the Commission shall cease and determine as to each specific matter of regulation and control prescribed in this Article as soon as the State shall have provided a commission or other authority for the regulation and control of that specific matter.

3414–O

ARTICLE 25. With the written consent of the Licensee, the Commission may by order made under its seal, and after the public notice required by Section 6 of the Act, modify, alter, enlarge or omit, in so far as authorized by law, any one or more of the conditions or provisions of this license.

ARTICLE 26. The enumeration herein of any rights reserved to the United States or to any State or municipality under the Act, or of any requirement of the Act or of said rules and regulations of the Commission shall not be construed in any degree as impairing any other rights so reserved by the Act or as limiting the force of any other requirement of said Act or of said regulations.

In witness whereof, the Federal Power Commission has caused its name and seal to be hereto signed and affixed by its

FEDERAL POWER COMMISSION,

By ——— ———, *Executive Secretary.*

3414–P . In testimony of acceptance of all the terms and conditions of the Federal water power act of June 10, 1920, and of the further conditions imposed in the foregoing license, the Licensee, this day of , has caused its name and corporate seal to be hereto signed and affixed by its pursuant to a resolution of its board of directors, passed on the day of , a certified copy of the record thereof being hereto attached.

APPALACHIAN ELECTRIC POWER CO.,
By ——— ———, *President.*

Attest:

——— ———, *Secretary.*

3414–Q *Government exhibit No. 131*

MAY 5, 1931.

APPALACHIAN ELECTRIC POWER COMPANY,
c/o MESSRS. CURTIS, MALLET-PREVOST, COLT & MOSLE,
*63 Wall Street, New York, N. Y.*

GENTLEMEN: Pursuant to the action taken by the Commission on April 3, 1931, there are forwarded herewith for acceptance duplicate copies of the draft of license for project No. 739, together with a copy of the Opinion and Order of that date.

Upon return of the signed instruments, both copies will be executed in this office and the original forwarded for your files.

Very truly yours,

GEO. OTIS SMITH, *Chairman.*

3 incls. 4343, 44, 45.
4 copies to Chief of Engineers.

3414–R FEDERAL POWER COMMISSION

License—Project No. 739—Virginia

APPALACHIAN ELECTRIC POWER COMPANY

Whereas, by Act of Congress approved June 10, 1920 (41 Stat. 1063), and any acts amendatory thereof or supplemental thereto, designated therein as "the Federal Water Power Act" and hereinafter called the "the Act," the Federal Power Commission, hereinafter called "the Commission," is authorized and empowered, inter alia, to issue licenses for the purpose of constructing, operating, and maintaining dams, water conduits, reservoirs, power houses, transmission lines, or other project works subject to the provisions, conditions, and requirements of said Act; and

Whereas, Appalachian Electric Power Company, hereinafter called "the Licensee," a corporation organized and existing under

the laws of the State of Virginia and having its office and principal place of business in the city of Richmond, in the State of Virginia, has made application in due and proper form to the Commission for a license for a power project designated as project No. 739 on the records of the Commission, and for authority to construct, maintain, and operate in the New River, in the vicinity of Radford, in the County of Pulaski, State of Virginia, certain project works, as hereinafter described, for the development, transmission, and utilization of power; and

Whereas, on September 4, 1926, the Appalachian Electric Power Company presented evidence of succession to the rights under the Declaration of Intention filed June 26, 1925, by New River Development Company; and

Whereas, the Licensee submitted to the Commission sat-
3414-S isfactory evidence of its compliance with the laws of the State of Virginia as required by section 9, subsection (b), of the Act, and the Commission is satisfied as to the ability of the Licensee to carry out the plans for said project as filed with said application; and

Whereas, notice of said application has been given and published by the Commission, as required by section 4 of the Act; full opportunity has been given to all interested parties to be heard, and no application for said project, or in conflict therewith, has been filed by any State or municipality; and

Whereas, the Commission on June 1, 1927, took action reciting that said project, unless operated in the interests of interstate or foreign commerce, would have an adverse effect on such interests, but if operated in accordance with such requirements would materially benefit such commerce; and

Whereas, on February 4, 1930, the Licensee, having previously rejected a standard-form license, requested the Commission to reconsider its finding as to the effect of said project upon the interests of interstate and foreign commerce, or, in the alternative, to issue a minor-part license for this project; and

Whereas, on April 3, 1931, the Commission denied said motion to reconsider, denied the application for a minor-part license and issued its order that Licensee be tendered a standard-form license under the Act and that construction of the proposed project should not proceed until such license should be accepted; and

Whereas, the maps, plans, and specifications of said project and of said project works, as hereinafter described, have been approved by the Commission, and the plans of the dam and other structures affecting navigation have been approved by the Chief of Engineers and the Secretary of War; and

Whereas, in the judgment of the Commission said project, as hereinafter described, will be best adapted to a comprehensive scheme of improvement and utilization of said waters
3414–T for the purposes of navigation and interests of navigation and/or interstate or foreign commerce, of water-power development, and other beneficial public uses; and

Whereas, the Licensee on the day of , 1931 pursuant to an authorization of its board of directors, a copy of the record thereof being hereto attached, accepted in writing all the terms and conditions of the Act and of this license;

Now, therefore, the Commission hereby issues this license to the Licensee for the purpose of constructing, operating, and maintaining certain project works for the development, transmission, and utilization of power across, along, from, or in said New River and constituting the project hereinafter described; said license, including the period thereof, being subject to all the terms and conditions of the Act and of the rules and regulations of the Commission pursuant thereto as amended and made effective on the first day of May 1928, as though fully set forth herein, which said rules and regulations are attached hereto and made a part hereof, and being subject also to the following express conditions and limitations, to wit:

ARTICLE 1. This license is issued for a period of fifty (50) years from the date hereof, "and in consideration of such license and the benefits and advantages accruing thereunder to the Licensee it is expressly agreed by the Licensee that the entire project, project area, and project works as hereinafter designated and described shall be subject to all the terms and conditions of this license, including the terms and conditions of the Act and of the rules and regulations of the Commission pursuant thereto and made a part of this license."

ARTICLE 2. The project covered by and subject to this license consists of—

A. All lands constituting the project area and inclosed, or the location of which is shown, by the project boundary, and/or interests in such lands necessary or useful for the purposes
3414–U of the project, such project area and project boundary being more fully shown and described by certain exhibits which accompanied said application for license and which are designated and described as follows:

Exhibit J—Map (FPC No. 739–1) with title "Location Map and Drainage Area (A. E. P.—R. D.—3001)."

Exhibit K—Map (FPC No. 739–9) with title "General Map of Project (A. E. P.—R. D.—3002)."

B. All project works consisting of a dam and a power house with appurtenant structures and equipment; the location, nature,

and character of which project works are more fully shown and described by certain exhibits which accompanied the applications for license and which are designated and described as follows:

Exhibit L—Maps and plans in two sheets (FPC Nos. 739–10, 13) with titles as follows: L–1 "Plan of Dam site (A. E. P.—R. D.—3003)."

L–4, "Elevation and Sections of Dam and Power Station (A. E. P.—R. D.—3005)."

Exhibit M—One typewritten sheet briefly describing the mechanical and electrical equipment;

Said exhibit signed on August 30, 1926, by N. M. Argabrite, Vice President, Appalachian Electric Power Company.

C. All other structures, fixtures, equipment, or facilities used or useful in the maintenance and operation of the project and located upon the project area, including such portable property as may be used and useful in connection with the project or any part thereof, whether located on or off the project area, if and to the extent that the inclusion of such property as a part of the project works is approved or acquiesced in by the Commission; also all other rights, easements, or interests, the ownership, use, occupancy, or possession of which is necessary or appropriate in the maintenance and operation of the project or appurtenant to the project area.

3414–V ARTICLE 3. The maps, plans, specifications, and statement designated and described in article 2 hereof as Exhibits J, K, L and M, respectively, and approved by the Chairman for the Commission in accordance with its authorization of are hereby made a part of this license and no substantial change shall hereafter be made in said exhibits, or any of them, until such change shall have been approved by the Commission; provided, however, that if the Licensee deems it necessary or desirable that said approved maps, plans, specifications, and statements, or any of them, be changed there shall be submitted to the Commission for approval amended, supplemental, or additional maps, plans, specifications, and statements covering the proposed changes, and upon approval by the Commission of such proposed changes such amended, supplemental, or additional maps, plans, specifications, and statements shall become a part of this license and shall supersede, in whole or in part, such map, plan, specification, or statement, or part thereof, theretofore made a part of this license as may be specified, respectively, in the order or endorsement of approval.

ARTICLE 4. Said project works shall be constructed in substantial conformity with the approved maps, plans, and specifications thereof made a part of this license and designated and described in

articles 2 and 3 hereof or as changed in accordance with the provisions of said article 3. Except when emergency shall require for the protection of navigation, life, health, or property, no substantial alteration or addition not in conformity with the approved plans shall be made to any dam or other project works constructed under this license without the prior approval of the Commission; and any emergency alteration or addition so made shall thereafter be subject to such modification and change as the Commission shall direct. Minor changes in or divergence from such approved maps, plans, and specifications may be made in the course of construction, if such changes will not result in decrease in efficiency, in material increase in cost, or in impairment of the general scheme of development; but any such minor changes made without the prior approval of the Commission which in its judgment have
3414–W produced or will produce any of such results shall be subject to such alteration as the Commission may direct.

ARTICLE 5. The work of construction under this license shall be subject to the inspection and approval of the District Engineer, U. S. Engineer Office, Huntington, W. Va., or of such other officer or agent as the Commission may designate, who shall be the authorized representative of the Commission for such purposes. The Licensee shall notify such representative of the date upon which work will begin, and as far in advance thereof as said representative may reasonably specify, and shall notify him promptly in writing of any suspension of construction for a period of more than one week, and of its resumption and completion.

ARTICLE 6. Subject to the provisions of Section 13 of the Act, the Licensee shall begin the construction of said project works within one year after date of issuance of this license, shall thereafter in good faith and with due diligence prosecute such construction, and shall complete the same within four years from said date.

ARTICLE 7. Upon the completion of the project works, or at such other time as the Commission may direct, the Licensee shall submit to the Commission for approval revised maps, plans, specifications, and statements, in so far as necessary to show any divergence from or variations in the project area as finally located or in the project works as constructed when compared with the area shown and the works designated or described in this license or in the maps, plans, specifications, and statements approved by the Commission under the provisions of article 3 hereof, together with a statement in writing setting forth the reasons which in the opinion of the Licensee necessitated or justified variations in or divergence from the approved maps,

plans, specifications, and statements. Such revised maps, plans, specifications, and statements shall, if and when approved by the Commission, be made a part of this license and shall, to the extent and in the particulars set forth in the order or endorsement of approval, be substituted for the maps, plans, specifications, and statements theretofore approved by the
3414–X Commission under the provisions of article 3 hereof. The maps finally approved by the Commission and made a part of this license under the provisions of article 3 and/or 7 hereof shall show the project area to an adequate scale and the boundary thereof either by legal subdivisions, by metes and bounds survey, or by uniform offsets from centerline survey. Said project area shall include all lands without respect to ownership and whether or not the exact boundaries can be definitely fixed and determined, the use and occupancy of which are or will be valuable or serviceable in the maintenance and operation of the project; on which are located or to which are appurtenant the project works (other than portable property) and the rights, easements, or interests likewise valuable and serviceable; and the ownership or possession, or the right of use and occupancy, of which are subject to acquisition by the United States under the provisions of Section 14 of the Act. Said maps shall show the ownership of each parcel of land in said project area, and with respect to each parcel to which the Licensee has not the fee title, the character of the right of use and occupancy possessed by the Licensee together with the term of such right.

ARTICLE 8. In so far as any material is dredged or excavated in the prosecution of the work herein authorized, it shall be removed and deposited so it will not interfere with navigation and to the satisfaction of said District Engineer.

ARTICLE 9. For the purpose of determining the stage and flow of the stream or streams from which water is to be diverted for the operation of said project works and of the amount of water held in and drawn from storage, the Licensee shall install and thereafter maintain such stream gages and stream gaging stations as may be necessary to determine the flow of the New River available to the project, a standard gage in the reservoir above the dam and an automatic recording gage in the stream below the tailrace of the power plant, and shall provide for the required readings of such gages and for the adequate rating of said station or stations. The Licensee shall also install and maintain standard meters adequate for the determination of the amount of electric energy generated by said project works. The
3414–Y number, character, and location of gages, meters, or other measuring devices, and the method of operation thereof may be altered from time to time if necessary to secure

adequate determinations, but such alteration shall not be made except with the approval of the Commission or its authorized representative or upon the specific direction of the Commission. The installation of gages, the ratings of said stream or streams, and the determination of the flow thereof, shall be under the supervision of the District Engineer of the United States Geological Survey having charge of stream gaging operations in the region of said project, and the Licensee shall reimburse the said United States Geological Survey for costs incurred in such supervision or for such part thereof as said Engineer may deem equitable in the circumstances. The Licensee shall keep accurate and sufficient record of the foregoing determinations to the satisfaction of the Commission, shall make return of such records annually, at such time and in such form as the Commission may prescribe.

ARTICLE 10. The Licensee shall maintain the project works in a condition of repair adequate for the efficient operation of said works in the development and transmission of power, shall make all necessary renewals and replacements, shall establish and maintain adequate depreciation reserves for such purposes, shall so maintain and operate said works as not to impair the interests and/or development of navigation and/or the interests of interstate or foreign commerce and shall conf to such rules and regulations as the Commission may fr.. time to time prescribe for the protection of life, health, and property. The Licensee shall be liable for all damages occasioned to the property of others by the construction, maintenance; or operation of the project works or of the works appurtenant or accessory thereto, constructed under the license and in no event shall the United States be liable therefor.

ARTICLE 11. In the construction and maintenance of the project works herein specified, the Licensee shall place and maintain suitable struct..es to reduce to a reasonable degree the liability of contact between its transmission lines and telegraph, telephone, and other signal wires or power transmission lines not owned by the Licensee, and shall also place and maintain suitable structures and devices to reduce to a reasonable degree the liability of any structures or wires falling and obstructing traffic and endangering life on highways, streets, or railroads.

3414–Z

ARTICLE 12. The Licensee shall allow officers and employees of the United States free and unrestricted access in, through, and across the said project and project works in the performance of their official duties.

ARTICLE 13. The United States specifically retains and safeguards the right to use water in such amount, to be determined

by the Secretary of War, as may be necessary for the purposes of navigation.

ARTICLE 14. The operations of the Licensee so far as they affect the use, storage, and discharge from storage of waters affected by the New River shall at all times be controlled by such reasonable rules and regulations as the Secretary of War may prescribe in the interests of navigation and as the Federal Power Commission may prescribe in the interests of flood control and of the fullest practicable use of said waters for power purposes.

ARTICLE 15. Whenever the flow at Lock No. 2, Kanawha River, falls below 1,400 second-feet, the Licensee shall, when so directed by the Secretary of War, discharge in each 24 hours the natural flow of the river at the dam site during that period up to a discharge of 1,150 acre-feet. The discharge from the project shall at all times be regulated by such rules and regulations as the Secretary of War may prescribe to prevent undue interference with navigation on the Kanawha River.

ARTICLE 16. The Licensee shall cut and remove or destroy to the satisfaction of the District Engineer all brush and trees from that zone within and adjacent to the area to be submerged which is included between the contour of elevation 1,815 feet above mean sea level and a line 15 feet horizontally outside of the contour of elevation 1,846 feet above mean sea level, and shall remove or destroy all floatable refuse or material within said area to be submerged. The Licensee shall also cut in such manner or so remove or destroy brush and trees within said area to be submerged that no part of such brush and trees shall project above said elevation of 1,815 feet.

3414–AA

ARTICLE 17. The Licensee hereby agrees as a condition of this license that the amount to be entered upon the fixed capital accounts of said project and reported to the Commission as representing the actual legitimate cost thereof and the actual legitimate investment therein up to the date of this license, whether consisting of expenditures actually made, or charges accrued, or of liabilities or obligations incurred, shall be determined by the Commission in accordance with the provisions of the Act and of the regulations established thereunder; and it is further agreed by the Licensee that upon completion of the construction of said project or of any addition to or betterment of said project the Licensee shall file with the Commission a statement, under oath in duplicate, in such detail as the Commission may require, showing the actual legitimate cost of construction thereof, together with the price paid for water rights, rights of way, lands or interest in lands constituting any part of the project property subject to the provisions of this license, all as specified

in regulation 20, section 2, of said rules and regulations. Such statement or statements shall include all proper and legitimate cost, whether incurred prior to the date of this license or on and after such date; and the Licensee shall, if requested by the Commission, show separately on such statement or statements the items and amounts of cost incurred prior to the issuance of this license as determined by the Commission as hereinbefore in this article provided, with such other details with respect to the cost of the project or any part thereof as the Commission may require. Each and every item of cost included in such statements shall be supported by proper voucher or other record; and any such voucher or record, or certified copy thereof, in support of any item properly includible in said cost shall become a part of the permanent records of said project and shall be kept and retained by the Licensee in the manner required by the Commission.

3414-BB

ARTICLE 18. Whenever the Licensee is directly benefited by the construction work of another licensee, a permittee, or of the United States of a storage reservoir or other headwater improvement, the Licensee shall reimburse the owner of such reservoir or other improvement for such part of the annual charges for interest, maintenance, and depreciation thereon as the Commission may deem equitable. The proportion of such charges to be paid by the Licensee shall be determined from time to time by the Commission. Whenever such reservoir or other improvement is constructed by the United States, the Licensee shall pay similar charges into the Treasury of the United States upon bills rendered by the Commission.

ARTICLE 19. The Licensee shall pay to the United States reasonable annual charges for the purpose of reimbursing the United States for the cost of the administration of the Act. The payment by the Licensee of such annual charges for any calendar year shall be made to the United States at the end of the year, or within thirty days thereafter, upon bills rendered or approved by the Commission. Such charges shall be determined in accordance with the provisions of regulation 14 of said rules and regulations of the Commission, and for the purposes of such determination the power capacity shall be taken as 12,100 horsepower.

ARTICLE 20. After the first twenty years of operation of said project under this license, out of surplus earned thereafter, if any, accumulated in excess of a specified reasonable rate of return upon the actual, legitimate investment of the Licensee in said project, all as defined in and determined by the provisions of regulation 17 of said rules and regulations of the Commission,

the Licensee shall establish and maintain amortization reserves, which reserves shall, in the discretion of the Commission, be held until the termination of the license or be applied from time to time in reduction of the net investment. Such specified rate of return shall, subject to the proviso of paragraph A, section 3 of said regulation, be one and one-half (1½) times the weighed average annual interest rate payable on the par value of the bona fide interest-bearing debt of the Licensee actually outstanding, in whole or in part, on account of project property
3414–CC at the beginning of the period of amortization and of each calendar year thereafter; such weighted average annual interest rate being determined as provided in paragraphs B and C of section 3 of said regulation 17; provided, that if at the beginning of the period of amortization or of any calendar year thereafter, the outstanding interest-bearing debt of the Licensee on account of the project or projects under license, together with any other works or property operated in connection therewith, is less than 25 percent of the actual, legitimate investment of the Licensee in said project or projects, then and in such event for the calendar year next following the specified rate of return shall be two (2) times the legal rate of interest in the State in which the project or major part thereof is located.

Subject to the provisions of section 6 of said regulation, the following proportions of such surplus earnings shall be paid into and held in such amortization reserves: Of all surplus earnings up to and including 2 percent upon the actual, legitimate investment, 30 percent thereof shall be so paid; of all surplus earnings in excess of 2 percent and not in excess of 4 percent upon such investment, 50 percent thereof shall be so paid; of all surplus earnings in excess of 4 percent and not in excess of 6 percent, 70 percent thereof shall be so paid; and of all surplus earnings in excess of 6 percent, 90 percent thereof shall be so paid; provided that if at the end of any calendar year of the amortization period the Commission shall find that the accumulated earnings of the Licensee during the period of operation, including the first twenty (20) years thereof, have not yielded a fair return upon the actual, legitimate investment in the project or projects under license, the proportion of such surplus earnings for such calendar year and for succeeding calendar years to be paid into such amortization reserves shall be ten (10) percent thereof until such time as the accumulated earnings of the Licensee represent in the judgment of the Commission, a fair return upon such investment for such period of operation.

ARTICLE 21. No lease of said project or part thereof whereby the lessee is granted the exclusive occupancy, possession, or use of the project works for purposes of generating transmitting,

3414-DD or distributing power shall be made without the prior written approval of the Commission; and the Commission, may if in its judgment the situation warrants, require that all the conditions of this license, of the Act, and of said rules and regulations of the Commission shall be applicable to such lease and to such property so leased to the same extent as if the lessee were the Licensee hereunder; provided that the provisions of this article shall not apply to parts of the project or project works which may be used by another jointly with the Licensee under a contract or agreement whereby the Licensee retains the occupancy, possession, and control of the property so used and receives adequate consideration for such joint use, or to leases of land while not required for purposes of generating, transmitting, or distributing power, or to buildings or other property not built or used for said purposes, or to minor parts of the project or project works, the leasing of which will not interfere with the usefulness or efficient operation of the project by the Licensee for said purposes.

ARTICLE 22. It is hereby understood and agreed that the Licensee, its successors, and assigns will, during the period of this license, retain the possession of all project property covered by this license as issued or as hereafter amended, including the project area, the project works, and all franchises, easements, water rights, and rights of occupancy and use; and that none of such properties valuable and serviceable to the project and to the development, transmission, and distribution of power therefrom will be voluntarily sold, transferred, abandoned, or otherwise disposed of without the approval of the Commission; provided, that a mortgage or trust deed or judicial sales made thereunder, or tax sales, shall not be deemed voluntary transfers within the meaning of this article. The Licensee further agrees, on behalf of itself, its successors, and assigns, that, in the event said project is taken over by the United States upon the termination of this license, as provided in section 14 of the Act, or is transferred to a new licensee under the provisions of section 15 of the Act, it will be responsible for and will make good any defect of title to or of right of user in any such project property which is necessary or appropriate or valuable and serviceable in the maintenance and operation of the project, and will pay and discharge or will

3414-EE assume responsibility for payment and discharge of all liens or incumbrances upon said project or project property created by said Licensee or created or incurred after the issuance of this license; provided, that the provisions of this article are not intended to prevent the abandonment or the retirement from service of structures, equipment, or other project

works in connection with replacements thereof when they become obsolete, inadequate, or inefficient for further service due to wear and tear, or to require the Licensee for the purpose of transferring the project to the United Etates or to a new licensee to acquire any different title or right of user in any such project property than was necessary to acquire for its own purposes as Licensee.

ARTICLE 23. The Licensee shall abide by such reasonable regulation of the services to be rendered to customers or consumers of power, and of rates and charges of payment therefor, as may from time to time be prescribed by any duly constituted agency of the State in which the service is rendered or the rate charged; and in case of the development, transmission, distribution, sale, or use of power in public service by the Licensee or by its customers engaged in public service within a State which has not authorized and empowered a commission or other agency or agencies within said State to regulate and control the services to be rendered by the Licensee or by its customers engaged in public service, or the rates and charges of payment therefor, or the amount or character of securities to be issued by any of said parties, it is agreed as a condition of this license that jurisdiction is hereby conferred upon the Commission, upon complaint of any person aggrieved or upon its own initiative, to exercise such regulation and control until such time as the State shall have provided a commission or other authority for such regulation and control; provided, that the jurisdiction of the Commission shall cease and determine as to each specific matter of regulation and control prescribed in this article as soon as the State shall have provided a commission or other authority for the regulation and control of that specific matter.

ARTICLE 24. Combinations, agreements, arrangements, or understandings, express or implied, to limit the output of electrical energy, to restrain trade, or to fix, maintain, or increase prices for electrical energy or service are hereby prohibited.

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ARTICLE 25. With the written consent of the Licensee, the Commission may by order made under its seal, and after the public notice required by section 6 of the Act, modify, alter, enlarge, or omit, in so far as authorized by law, any one of more of the conditions or provisions of this license.

ARTICLE 26. The enumeration herein of any rights reserved to the United States or to any State or municipality under the Act, or of any requirement of the Act or of said rules and regulations of the Commission shall not be construed in any degree as impairing any other rights so reserved by the Act or as limiting the force of any other requirement of said Act or of said regulations.

In witness whereof, the Federal Power Commission has caused its name and seal to be hereto signed and affixed by

FEDERAL POWER COMMISSION.

By ——— ———.

In testimony of acceptance of all the terms and conditions of the Federal Water Power Act of June 10, 1920, and of the further conditions imposed in the foregoing license, the Licensee this day of , has caused its name and corporate seal to be hereto signed and affixed by , its , pursuant to a resolution of its board of directors passed on the day of , a certified copy of the record thereof being hereto attached.

APPALACHIAN ELECTRIC POWER COMPANY,

By ——— ———, *President.*

Attest:

———— ————, *Secretary.*

3414-GG *Government exhibit no. 132*

Plate 11.—Diagram showing change in wave as it passes downstream. (Original Exhibit.)

*Government exhibit No. 133*

March 1930—Discharge hydrograph wave study of New River at Allisonia, Va., from March 11, 1930–March 31, 1930. (Original Exhibit.)

*Government exhibit No. 134*

March 1930—Discharge hydrograph wave study New River at Eggleston, Va., from March 11, 1930–March 31, 1930. (Original Exhibit.)

*Government exhibit No. 135*

March 1930—"Discharge hydrograph wave study New River at Glen Lyn, Va., March 12, 1930–March 30, 1930. (Original Exhibit.)

*Government exhibit No. 136*

March 1930—"Discharge hydrograph wave study New River at Hinton, W. Va., March 13, 1930–March 30, 1930. (Original Exhibit.)

*Government exhibit No. 137*

March 1930—"Discharge hydrograph wave study New River at Caperton, W. Va.—March 12, 1930 to Apr. 3, 1930. (Original Exhibit.)

*Government exhibit No. 138*

1930 March—"Discharge hydrograph wave study New River at Damsite "A" near Radford, Va., March 11, 1930 to March 31, 1930." (Original Exhibit.)

3415 *Government exhibit No. 139*

1930, March—"Discharge hydrograph wave study at Kanawha River at Kanawha Falls, W. Va., March 12, 1930 to April 1, 1930." (Original Exhibit.)

*Government exhibit No. 140*

1930, March—"Discharge hydrograph wave study of New River at Ivanhoe, March 12, 1930 to March 31, 1930." (Original Exhibit.)

*Government exhibit No. 141*

1930, March—"Discharge hydrograph wave study of Kanawha River at Montgomer', W, Va. (Lock #2), March 14 to March 31, 1930." (Original Exhibit.)

3416 *Government exhibit No. 142*

1935—System Load Curve, A. E. P. Co. and Amer. Gas & Electric Co.—Week Day, Oct. 28, 1935, Sat. Nov. 2nd, 1935, and Sunday, Nov. 3rd, 1935.

3418 *Government exhibit No. 143*

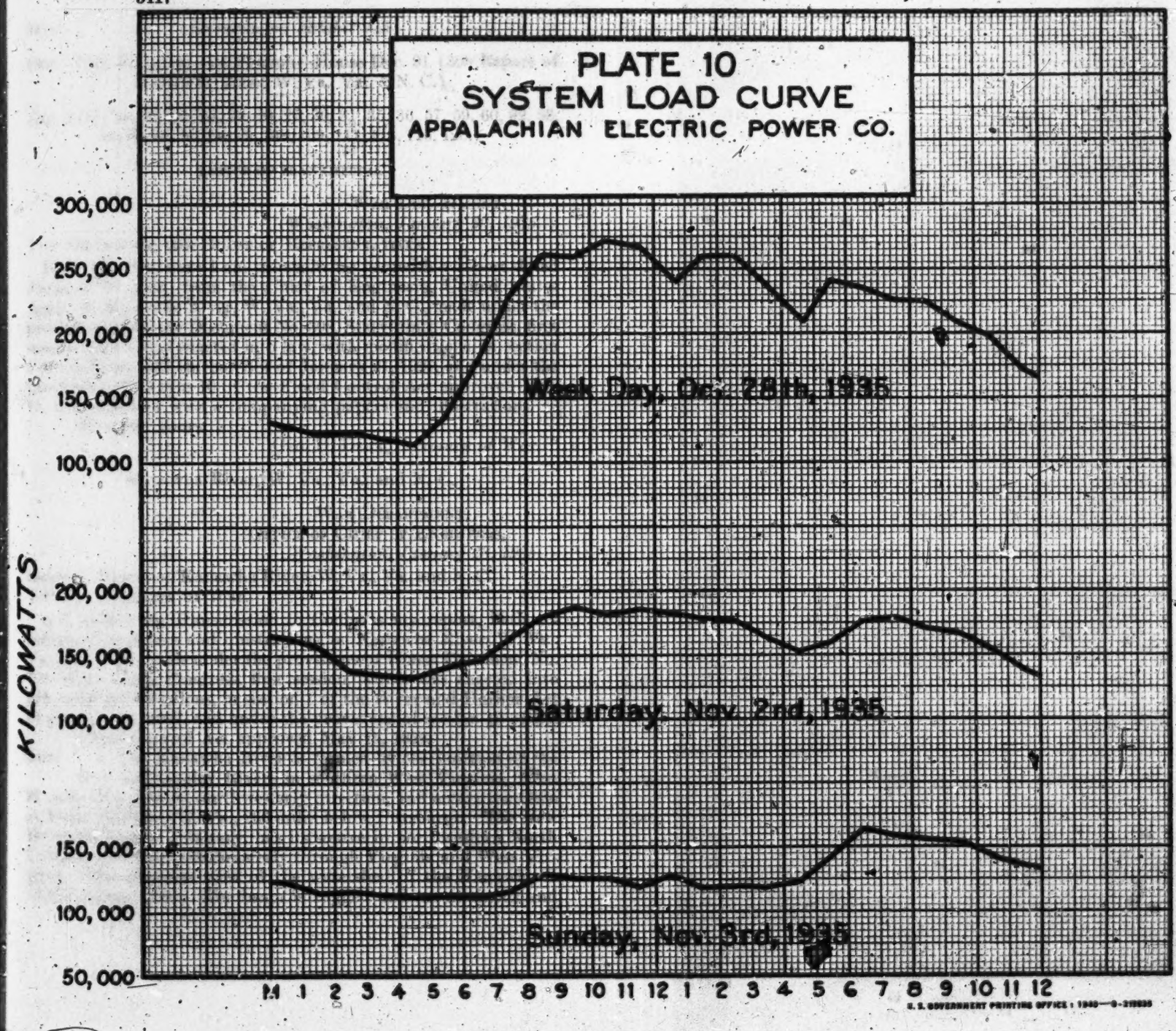
1930—June 1, chart "New Kanawha River Power Waves 3/11/30 to 4/3/30." (Original Exhibit.)

*Government exhibit No. 144*

10 sheets—Plans of locks & dams, Nos. 2 to 11, incl. on Kanawha River, as follows:

(a) Kanawha River—Lock and Dam No. 2.
(b) Kanawha River—Lock and Dam No. 3.
(c) Kanawha River—Lock and Dam No. 4.
(d) Kanawha River—Lock and Dam No. 5.
(e) Kanawha River—Lock and Dam No. 6.
(f) Kanawha River—Lock and Dam No. 7.
(g) Kanawha River—Lock and Dam No. 8.
(h) Kanawha River—Lock and Dam No. 9.
(i) Kanawha River—Lock and Dam No. 10.
(j) Kanawha River—Lock and Dam No. 11.
(Original Exhibit.)

3417



3419 *Government exhibit 145*

1935—74th Congress—1st Session—House Doc. 91 (308 Report of Kanawha River, W. Va., Va., & N. C.)

(pp. 1–17; 18, 20, 22, 23, 24, 26, 27, 30, 31, 35, 36, 57, 59, 60, 92, 93, 94, 95, 96, 97, 98, 99, 108, 109, 111, 113, 115, 120,)

LETTER OF TRANSMITTAL

WAR DEPARTMENT,
*Washington, January 29, 1935.*

THE SPEAKER OF THE HOUSE OF REPRESENTATIVES.

DEAR MR. SPEAKER: I am transmitting herewith a report dated January 28, 1935, from the Chief of Engineers, United States Army, on Kanawha River, W. Va., Va., and N. C., made under the provisions of House Document No. 308, Sixty-ninth Congress, first session, which was enacted into law, with modifications, in section 1 of the River and Harbor Act of January 21, 1927, and under the provisions of section 10 of the Flood Control Act approved May 15, 1928, together with accompanying papers and illustrations.

Sincerely yours,

GEO. H. DERN, *Secretary of War.*

Kanawha River, W. Va., Va., and N. C.

WAR DEPARTMENT,
OFFICE OF CHIEF OF ENGINEERS,
*Washington, January 28, 1935.*

Subject: Report on Kanawha River, W. Va., Va., and N. C.
To: The Secretary of War.

1. I submit for transmission to Congress my report, with accompanying papers and illustrations, on Kanawha River, W. Va., Va., and N. C., made under the provisions of House Document No. 308, Sixty-ninth Congress, first session, which was enacted into law, with modifications, in section 1 of the River and Harbor Act of January 21, 1927, and under the provisions of section 10 of the Flood Control Act approved May 15, 1928.

3420 2. The Kanawha River is formed by the junction of the New and Gauley Rivers in southern West Virginia, flows 97 miles in a general northwesterly direction, and enters the Ohio at Point Pleasant, W. Va., 266 miles below Pittsburgh. The New River, its largest tributary, has its source in northwestern North Carolina and flows northeasterly through Virginia and West Virginia. The drainage area of the watershed of the Kanawha is 12,300 square miles. The basin is rugged and mountainous and

the stream valleys are generally narrow with little level botto land.

3. The Kanawha Basin has large natural resources in bitumino coal, natural gas, petroleum and other minerals, and some timbe The coal is of excellent quality. The principal industries are co mining, agriculture, gas and petroleum productions, manufactu ing, electrical metallurgy, and lumber. The population of t basin is 725,000, the largest city being Charleston, W. Va., with population of 60,000.

4. Navigation.—A project was completed in 1898 for slac watering the main stem of the river by the construction of 10 loc and dams to afford a channel 6 feet deep through the river to t foot of Kanawha Falls at its head. This improvement is no being modernized by the construction of 3 high-lift locks a dams in the Kanawha River and 1 high-lift lock and dam in t Ohio below the mouth of the Kanawha to replace the 10 old loc and dams in the Kanawha and 3 in the Ohio and to afford channel 9 feet deep with locks suitable for modern barge nav gation. Two of the new locks and dams have been complet and placed in operation.

5. The larger tributaries of the Kanawha River, and partic larly the New River, were formerly used to a limited extent f trade and transportation, and improvements were made by t United States on the New, Gauley, and Elk Rivers by removi rocks and snags and by minor channel excavation. A special boa reported on March 18, 1874, that it was entirely practicable to co nect the waters of the James and Ohio Rivers by water navigation

. feet in depth. The canal route after crossing the divide b
3421 tween the watershed was to follow the Greenbrier, New, a
Kanawha Rivers. The River and Harbor Act of 1902 r pealed the provisions of prior acts providing for the improveme of New River. Commerce on these tributaries has practically di appeared, and no substantial commerce upon them can be anti pated in their present condition.

6. The larger tributaries of the Kanawha are susceptible of i provement for navigation by the utilization of the pools form by the construction of high dams for power and flood-contr purposes, if locks or other devices are constructed for passi vessels from one pool to another. The large cost of providi and operating such locks or other devices does not appear to justified by any commerce immediately in prospect, and no gener plans are now presented for the utilization of these tributaries routes for modern barge navigation. Reservoirs on the Ne River for power and for the control of flood waters can be o erated to afford some beneficial effect on navigation on the ma

stem of the Kanawha and on the Ohio, and will reduce the heights of destructive floods on these streams. General plans for such reservoirs are herein considered.

7. Power.—Because of the steep slopes of the tributaries of the Kanawha River and the abundant rainfall, the basin is especially suited to the development of water power. A small part of the potential power is now developed at 3 plants on the upper reaches of the New River and 1 plant at Kanawha Falls at the head of the Kanawha River. Another project known as the "Hawks Nest project" on the lower reaches of the New River is approaching completion. Two plants are being constructed, under license from the Federal Power Commission, to utilize the surplus water at the navigation dams recently completed in the upper part of the Kanawha River. The total installed capacity of the plants now in operation is 36,400 kilowatts and of the plants under construction about 160,000 kilowatts. The development of the surplus water on the third navigation dam to be constructed on the Kanawha River is anticipated under license from the Federal Power Commission.

8. The Federal Power Commission, in a resolution adopted October 12, 1932, found and declared that the New River from
3422 the mouth of Wilson Creek, Va., north is navigable water within the definition thereof as set forth in section 3 of the Federal Water Power Act. The Federal Power Commission is empowered to issue licenses for the constructing, operating, and maintaining dams, reservoirs, power houses, and appurtenant works on navigable waters of the United States, and to license the utilization of surplus water or water power from any Government dam. The construction and operation of dams by the Federal Government or by any other agency under license from the Federal Power Commission provides a procedure for the utilization of the water resources in a manner best serving the general public advantage.

9. The report of the district engineer contains plans for the comprehensive development of the water power on the Kanawha River and the New and Gauley Rivers. On the New River and its tributaries the plans provide for a series of dams with a storage reservoir capacity of nearly 1,400,000 acre-feet, the utilization of upward of 2,000 feet of head, and the development of 454,000 primary horse power or nearly 1,500,000 primary peak horsepower at 30 percent load factor. The estimated cost of the entire development is $151,000,000 and the cost per kilowatt-hour at the switchboards is estimated at 4½ mills. The regulated flow at the mouth of the river would be 4,160 second-feet. On the Gauley River Basin the comprehensive development would include a

series of dams with a storage capacity of 174,200 acre-feet, the utilization of 1,442 feet of head, and the development of 71,000 primary horsepower or nearly 237,000 primary peak horsepower, at 30 percent load factor, at an estimated cost of $33,328,000. The estimated cost per kilowatt-hour is 6⅓ mills at the switchboards. The regulated flow at the mouth of the river would be 720 second-feet.

10. On the main stem of the river the regulated flow of the tributaries would afford at the Kanawha Falls plant and the three navigation dams a total of 51,000 primary horsepower or about 123,000 primary peak horsepower at 41 percent load factor, at a cost of from 3.15 to 4.3 mills at the switchboards. The New and Gauley Rivers are the tributaries best suited to water-power development and flood-control purposes. Detailed
3423 investigations of the power resources of the lesser tributaries may be deferred until the development of the capacity of the major tributaries has taken definite form.

11. Flood control.—The Kanawha River is subject to occasional destructive floods. The district engineer estimates that the average annual flood damage in the basin is $1,000,000, of which $800,000 is in the main valley. He presents a plan for the construction of a system of four reservoirs at an estimated cost of $26,800,000 and with a capacity sufficient to reduce floods below the stage at which damage occurs. The estimated annual cost of such a system is $1,870,000 and the annual benefits $800,000. He, therefore, concludes that the construction of the entire system is not economically justified. The construction and operation of flood-control reservoirs to reduce floods in the lower Mississippi River is similarly found to be without economic justification.

12. Irrigation.—As the natural precipitation in the basin is ordinarily ample for all crops, irrigation is not needed.

13. Bluestone Reservoir.—The studies of the river basin showed that the most favorable site for a large reservoir is on the New River immediately above the town of Hinton, W. Va., designated as the Bluestone Reservoir. A dam 150 feet in height would afford a reservoir 36 miles in length lying in the States of Virginia and West Virginia with a gross capacity of 625,000 acre-feet and controlling the run-off in 4,565 square miles. The district engineer finds that this reservoir could be operated to reduce floods on the Kanawha and the Ohio Rivers, to increase the low-water discharge of the New River to 2,000 cubic feet per second; which is about three times the natural minimum discharge, and to produce power, the revenue from which he estimated at over $900,000 annually. At maximum draw-down a head of 66 feet would be available during a year of extreme low

flow. The primary power produced from this minimum flow at minimum head would be but a minor part of the computed power output of the reservoir, the remainder being secondary power which could be disposed of only into a system for
3424 the replacement of steam power. The district engineer reports that the system of the American Gas & Electric Co. in this region could absorb all of the power that could be generated by the proposed project. The estimated cost of the dam, reservoir, and hydroelectric power plants is $13,000,000. The estimated annual cost of maintenance and operation is $208,000, and the interest on the construction cost at 4 percent is $520,000, giving a net carrying charge of $728,000. In addition to the return from the sale of power, the flood-control benefits are estimated at $250,000 annually for the Kanawha River and $120,000 annually for the Ohio River, these benefits being apparently derived by prorating the benefits from a complete system of flood protection. The district engineer considers that the Bluestone Reservoir project is economically justifiable and recommends its construction. The division engineer concurs in this recommendation.

14. The Mississippi River Commission finds that the effect of a complete system of storage reservoirs in the basin of the Kanawha River would reduce flood heights in the Mississippi River at Cairo by an amount only from 0.3 to 0.1 of a foot in the stages of a major flood. The Commission concludes that under present conditions the greatest benefits would be secured by the construction of the Bluestone Reservoir for the combined purpose of local flood control and water power as recommended by the reporting officers.

15. These reports have been referred, in accordance with law, to the Board of Engineers for Rivers and Harbors. The Board finds that the project now under way for modernizing the slack-water improvement of the Kanawha River to afford a 9-foot channel with locks of adequate dimensions, will provide a completely adequate improvement of the main stem of the river. It recommends the construction of the Bluestone Reservoir in the interest of flood control, navigation, and power production in accordance with plans prepared under the direction of the Chief of Engineers and approved by him at a total estimated cost of $12,942,000 provided that a definite agreement is entered into before construction is begun for the disposal of the power at prices and under conditions that in the opinion of the Secretary of
3425 War will fully protect the public interest.

16. After due consideration of these reports, I concur in the views and recommendations of the Board. The projects authorized by Congress and by the Public Works Administration for the modernization of the navigation works on the Kanawha

River, now well advanced toward completion, afford the most effective improvement of the main stem for the purposes of navigation and for the most efficient development of water power in combination with such improvement. The tributaries of the river and especially the New River, have large potential power resources which can be developed by water conservation in storage reservoirs and the utilization of the stored water at a series of dams and power houses. Under effective and unified control these reservoirs can be operated to reduce the height of destructive floods on the Kanawha and Ohio Rivers, to benefit navigation by reducing flash floods from these tributaries, and to increase the low-water flow of the river in the interest of sanitation and navigation. Such control can be effected by Federal construction and operation or by private construction and operation under license from the Federal Power Commission. A comprehensive plan for the complete development of the water resources is submitted with this report. It can best be accomplished in successive steps at a rate suitable for utilization of the power. The work of greatest immediate general public advantage is the construction of the Bluestone Reservoir, which can be operated to afford a large measure of flood control and water conservation and at the same time yield a substantial return from power production. I therefore recommend the construction by the Federal Government of the Bluestone Reservoir project for the purposes of power development, flood control, and navigation in accordance with the general plans set forth in this report with such modifications as may be approved by the Chief of Engineers, at an estimated cost of $13,000,000, provided that definite agreement is entered into before construction is begun for the disposal of the power at prices and under conditions that in the opinion of the Secretary of War will fully protect the public interest.

E. M. MARKHAM,
*Major General, Chief of Engineers.*

3426 REPORT OF THE BOARD OF ENGINEERS FOR RIVERS AND HARBORS

Syllabus

The Board of Engineers for Rivers and Harbors is of the opinion that the projects now under construction will provide adequately for navigation on the main stem of the Kanawha, and that no extension of navigation up the tributaries is justified at this time. The Board recommends the adoption of a project for the construction of a reservoir on the New River at the Bluestone site for flood control, power production, and navigation benefits, to be prosecuted under the direction of the Secretary of

War in accordance with plans prepared under the direction of the Chief of Engineers and approved by him, at a total estimated cost of $12,942,000, provided that definite agreement is entered into before construction is begun for the disposal of the power at prices and under conditions that, in the opinion of the Secretary of War, will fully protect the public interest.

(Second endorsement)

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
*Washington, D. C., January 11, 1935.*

To the CHIEF OF ENGINEERS, UNITED STATES ARMY.

1. The following is in review of the report on Kanawha River, West Virginia, Virginia, and North Carolina, made under the provisions of House Document No. 308, sixty-ninth Congress, first session, which was enacted into law, with modifications in section 1 of the River and Harbor Act of January 21, 1927, and under the provisions of section 10 of the Flood Control Act of May 15, 1928.

2. The Kanawha River is formed by the junction of the New and Gauley Rivers in southern West Virginia, and flows in a generally northwesterly direction to empty into the Ohio at Point Pleasant, 266 miles below Pittsburgh. The length of the Kanawha itself is 97 miles and the drainage area of the watershed is 12,300 square miles, three-fourths of which lies above the head of the Kanawha. The basin is in general very rugged in character with elevations varying from 5,500 to 500 feet. The valleys through which the Kanawha and its tributaries flow are in general narrow, the level land in the basin being inconsiderable in amount.

3427 3. The Kanawha Valley has large natural resources, chief among which are bituminous coal, natural gas, petroleum, clay, stone, lime, and some timber. The coal, of which there are large reserves, is of excellent quality suitable for steam, metallurgical purposes and for the production of by-product coke. The principal industries of the area are coal mining, agriculture, gas and petoleum productions, manufacturing, electrometallurgy, and lumbering. The basin as a whole has a population of 725,000. Charleston, W. Va., with 60,000 being the largest city. The basin is well served in regard to communications by five large railroads, a number of improved highways, and a navigable channel in the main river.

4. Navigation.—The improvement of the Kanawha River for navigation was authorized in 1875 to provide the construction of locks and dams to afford a channel 6 feet deep to the foot of

Kanawha Falls, which lie at the head of the main stem of the river. The improvement was completed in 1898. Two fixed and eight movable dams were constructed with single locks varying in dimensions from 50 by 271 feet to 55 by 315 feet. In accordance with the provisions of the River and Harbor Act of 1930, the 4 upper locks and dams are being replaced by 2 new high-lift dams with twin locks of standard Monongahela dimensions, 56 by 360 feet, and with funds provided under the National Industrial Recovery Act the construction of 2 locks and dams has been undertaken, 1 in the Kanawha itself and one in the Ohio River at Gallipolis below the mouth of the Kanawha, to replace the remaining low-lift dams. The Kanawha River dam has twin locks of the standard Monongahela type and the Ohio River dam has twin locks, one 110 by 600 feet and the second 110 by 360 feet. When completed, this improvement will provide an excellent navigable channel 9 feet deep, and will provide adequately for the needs of the basin for water transportation. None of the tributaries, because of their unfavorable natural characteristics, are suitable for development for navigation, although prior to 1902 the United States expended funds intermittently on some of the tributaries to facilitate rafting and shallow-draft navigation.

5. Power.—Because of the steep slopes of the tributaries of the Kanawha River and the abundant rainfall, the basin
3428 is especially suited to the development of water power. A relatively small part of the potential water power is now developed at three plants on the upper reaches of the New River, and one plant at Kanawha Falls at the head of the Kanawha River. Another project, known as the "Hawks Nest project", on the lower reaches of the New River, is approaching completion. Two plants are being constructed under license from the Federal Power Commission, to utilize the surplus water at the navigation dams recently completed in the upper part of the Kanawha River. The total installed capacity of the plants now in operation is 36,400 kilowatts and of the plants under construction about 160,000 kilowatts. The development under license from the Federal Power Commission of the surplus water on the remaining navigation dam to be constructed on the Kanawha River is anticipated.

6. The district engineer presents plans for the comprehensive development of water power on the Kanawha River and its principal tributaries. The power installations now under construction at the two completed navigation dams on the Kanawha and that contemplated at the remaining modern navigation dam to be constructed will provide for the complete development of the poten-

tial power on the main stem of the river, except at the private development at Kanawha Falls, where additional generating capacity would be required to develop the full power that would be made available by the conservation of water in the tributaries. On the New River and its tributaries the comprehensive plan for power development includes the construction of a series of dams with a storage reservoir capacity of 1,376,300 acre-feet, the utilization of about 2,055 feet of head, and a development of nearly 1,500,000 primary peak horsepower. The estimated cost of the entire development is $151,000,000; and the cost per kilowatt-hour at the switchboards 4½ mills. The regulated flow at the mouth of the river would be 4,160 second-feet. On the Gauley River Basin the comprehensive development would include a series of dams with a storage capacity of 174,200 acre-feet, the utilization of 1,442 feet of head, and the development of 237,000 primary
3429 peak horsepower. The estimated cost of the development is $33,328,000 and the cost per kilowatt-hour 6⅓ mills at the switchboards. The regulated flow at the mouth of the river would be 720 second-feet. On the main stem of the river the regulated flow would afford at the Kanawha Falls plant and the three navigation dams a total of 123,000 primary peak horsepower, at a cost of 3.15 and 4.3 mills at the switchboard.

7. Flood control.—The estimated average annual flood damage in the Kanawha Basin is $1,000,000, of which $800,000 is in the main valley. Flood protection by levees appears impracticable due to the restricted widths in the valleys in the watershed. The district engineer's estimate of construction cost of a system of 4 reservoirs with a capacity sufficient to reduce floods below the "no damage line" is $26,800,000. He estimates the annual costs of this plan at $1,870,000 and the annual benefits to be $800,000.

8. The district engineer has investigated the feasibility of constructing and operating flood reservoirs for flood relief in the lower Mississippi Basin. His plan embraces four reservoirs, with a total capacity of about 1,600,000 acre-feet estimated to cost about $32,750,000. His studies indicate that if these reservoirs were operated primarily for the benefit of the Mississippi Basin, a reduction of 0.3 to 0.1 foot at the Cairo gage would have resulted, that the flood benefits in the Kanawha Basin would have been about $100,000 per annum, and that an increase in low flow of about 1,400 cubic feet per second could have been obtained. Also incidental benefits to power development and flood control in the Ohio River Valley would have resulted. He is of the opinion that the total benefits from this system would, however, not be commensurate with its costs.

9. Irrigation.—As the natural precipitation in the basin is ordinarily ample for all crops, irrigation is not practiced.

10. The most favorable site for a large reservoir developed in the studies of the river basin was on the New River immediately above the town of Hinton, W. Va., designated as the
3430 "Bluestone Reservoir." This reservoir is more fully discussed in a supplementary report of the district and division engineers. At this site the foundations are excellent and the cost of lands and improvements overflowed are relatively small. A dam 150 feet in height would afford a reservoir 36 miles in length with a gross capacity of 625,000 acre-feet, controlling the run-off from 4,565 square miles. The district engineer finds that with an installed generating capacity of 90,000 kilowatts, power could be developed, in a year of average flow, to the amount of 268,000,000 kilowatt-hours of power salable at 3 mills as replacement for steam-generated power and 134,000,000 kilowatt-hours of dump power salable at 1 mill, the total revenue from which would amount to over $900,000. He finds that when operated to produce this power the reservoir would have reduced most floods that have occurred since 1897 to bank-full stage in the Kanawha, except for those floods which did not have their origin in the New River. He finds further that the operation of the reservoir for flood control only would not have provided much greater relief from flood damage than the proposed operation for flood control combined with power production. The operation of the reservoir for the two purposes as proposed would increase the low-water discharge of the New River to 2,000 cubic feet per second, the natural minimum being 600 cubic feet per second. At maximum draw-down a head of 66 feet would be available during the year of extreme low flow. The primary power produced from this minimum flow at minimum head would be but a minor part of the computed power output of the reservoir, the remainder being secondary power which could be disposed of only into a system for the replacement of steam power. The district engineer reports that the system of the American Gas & Electric Co. in the region could easily absorb all of the power that could be generated by the proposed project.

11. The estimated cost of the dam, reservoir, and hydroelectric power plant is $13,000,000. The estimated annual cost of maintenance and operation is $208,000, and the interest on the cost of construction, at 4 percent, is $520,000, giving a net carrying
3431 charge of $728,000. The return from the sale of power is estimated at $940,000 and the flood-control benefits are estimated at $250,000 annually for the Kanawha Valley and $120,-

000 annually for the Ohio River; these benefits being apparently derived by prorating the benefits from a complete system of flood protection. The district engineer considers that the Bluestone project is economically justifiable and recommends the construction. The division engineer concurs in this recommendation.

12. The Mississippi River Commission, to whom the reports were referred, states that the effect of the construction of storage reservoirs in the basin of the Kanawha River on the flood heights of the Mississippi River at Cairo would be a possible average reduction varying from three-tenths to one-tenth of a foot in the stages of the major floods. However, the cost of this reduction would be relatively very high, and from a consideration of the supplemental report relative to the Bluestone Reservoir project in the Kanawha River Basin, the Commission concludes, that under present conditions, the greatest benefits would be secured by the construction of the Bluestone Reservoir for the combined purpose of flood control and water power, as recommended by the reporting officers.

Views and recommendations of the Board of Engineers for rivers and harbors

13. The project now under way for modernizing the slack-water improvement of the Kanawha River to afford a 9-foot channel with locks of adequate dimensions will provide a completely adequate improvement of the main stem of the river. Because of the steep slopes of the tributaries their improvement for navigation either as a separate undertaking or in combination with power development or flood control, is not economically practicable. These tributaries have large power potentialities comparatively little of which is yet developed. The general plan for the ultimate development of the power resources including the conservation of floods as presented by the district engineer, provides for the full utilization of these resources, but the complete accom-
3432 plishment of this plan cannot be forseen for a long period.

The construction of a comprehensive system of reservoirs for flood control only is not economically justifiable, and the potential reservoir capacity can be used to greater economic benefit for power production with incidental flood control benefits, rather than being reserved for flood control purposes only.

14. The construction of the Bluestone Reservoir will control ordinary floods in the New River, the largest tributary of the Kanawha, and the figures presented by the district engineer indicate that the power made available from the operation of the

reservoir to afford this measure of flood control could be sold to a distributing public utility corporation at prices which would render the project self-liquidating. This reservoir will not afford complete relief from flood hazards on the Kanawha, but will reduce materially the ordinary flood damages. It will have some beneficial effect on the floods of the Ohio. The amounts of the benefits for flood control on the Kanawha and on the Ohio are not, in the opinion of the Board, susceptible of definite evaluation, but are large. The operation of the reservoir will increase the low flow of the Kanawha River, improve sanitary conditions in the river, and enhance the value of the power developed at the Government dams on the Kanawha. The operation of the reservoir will be of some benefit also to navigation on the Kanawha and the Ohio below its mouth by reducing the flash rises which interfere with navigation and with the maintenance of the pools in the movable dams on the Ohio. The Board concurs with the division engineer and therefore recommends that the Bluestone Reservoir projects, combining flood control and water power development, with some benefits to navigation, be adopted and authorized to be prosecuted under the direction of the Secretary of War in accordance with plans prepared under the direction of the Chief of Engineers and approved by him, at a total estimated cost of $12,942,000, provided that definite agreement is entered into before construction is begun for the disposal of the power at
prices and under conditions that, in the opinion of the
3433 Secretary of War, will fully protect the public interest.

For the Board:

G. B. PILLSBURY,
*Brigadier General, Corps of Engineers,*
*Senior Member.*

REPORT OF THE DIVISION ENGINEER

Syllabus

When previously authorized and recommended navigation structures in Kanawha River are completed, a first-class waterway will be available throughout practically the entire length of the stream and further navigation improvement need not now be considered. Economical development of hydroelectric power appears feasible at a large number of sites in Kanawha Basin. A reservoir system is presented for the primary benefit of Mississippi flood conditions. The benefits of this reservoir system would not be commensurate with its cost. Irrigation is not practiced in this region. A plan of development is presented for Kanawha

Basin involving the improvement of navigation in combination with water power and flood control. At present, Federal participation therein appears justified only in the case of proposed navigation structures which have either already been authorized or previously recommended. A reservoir plan for comprehensive flood relief in the Kanawha Valley is considered which as a whole, does not appear to be economically justified. However, in the opinion of the division engineer, the Bluestone Reservoir project included in that plan and also in a tentative similar plan for the Ohio River, might be suitable for construction by the United States under the provisions of the National Recovery Act if found feasible from an engineering standpoint. With a view to determining the feasibility of this project, it is recommended that immediate authority be given to proceed with necessary further investigations at an estimated cost of $50,000.

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WAR DEPARTMENT,
OFFICE OF THE DIVISION ENGINEER,
UPPER MISSISSIPPI VALLEY DIVISION,
*St. Louis, Mo., October 21, 1933.*

Subject: Report of Kanawha River, W. Va., Va., and N. C.
To: The Chief Engineers, United States Army.

1. Authority.—This report on Kanawha River, W. Va., Va. and N. C., is submitted in compliance with the provisions of the River and Harbor Act of January 21, 1927, which authorized "Surveys in accordance with House Document No. 308, Sixty-ninth Congress, first session," and under the provisions of section 10 of the Flood Control Act of May 15, 1928.

2. Description.—Kanawha River is formed in southern West Virginia by the confluence of New and Gauley Rivers. It flows in a general northwesterly direction to empty into the Ohio River at Point Pleasant, W. Va., 266 miles below Pittsburgh, Pa., and 715 miles above Cairo, Ill. The principal characteristics of the stream are: Drainage area, 12,300 square miles; length of main stream, approximately 97 miles; average fall, about 1.4 feet per mile; and maximum, minimum, and mean discharges at Lock No. 2 (drainage area 8,470 square miles or 69 percent of the basin) 275,000,841, and 12,500 cubic feet per second, respectively. In general, the topography of the watershed is very rugged with only inconsiderable areas of flat land. The large tributaries (New, Greenbrier, Gauley, and Elk Rivers) have their sources in the Allegheny Mountains and, in consequence, have precipitous gradients.

Navigation

3. Existing project.—The existing navigation project for Kanawha River, adopted in 1875, originally provided for the construction of 9 locks with movable dams and 3 locks with fixed dams to secure a 6-foot navigable depth from the mouth of the stream to a point about 90 miles above. This project was later modified so as to reduce the number of movable dams to 8, and after 2 of the 3 fixed dams had been constructed, the construction of the third (No. 1) was postponed until the necessity for it should become more apparent. The 2 fixed and 8 movable dams, with single locks varying in dimensions from 50 by 271 feet to 55 by 313 feet, were completed during the period 1880 to 3435 1898, thus practically securing the then authorized facilities. The River and Harbor Act of July 3, 1930, provided for replacement of existing Locks and Dams Nos. 2, 3, 4, and 5, with two locks and dams, and for dredging in the section of the river above Charleston, W. Va. (mile 58), with a view to securing a navigable channel 9 feet in depth and 200 feet in width to the upper limits of the project. This new work is now being prosecuted by the construction of a high-lift dam at Marmet (mile 68), provided with twin locks of Monongahela standard size (56 by 360 feet), and a similar dam and locks at London (mile 83).

4. Other navigation improvements.—The Coal River Navigation Co. constructed, in the middle of the nineteenth century, eight small wooden locks and dams on that stream which extended slackwater for a distance of 34 miles above the mouth. This navigation system was maintained until about 1882 but then became inactive and the works have now practically been destroyed. From 1878 to 1902, the United States intermittently expended funds on open-channel improvements in the New, Gauley, and Elk Rivers to facilitate rafting and shallow-draft navigation. As these rivers are no longer used for such purposes except to a very minor extent, improvements of this character are not now warranted.

5. Proposed navigation improvements.—Because of their unfavorable natural characteristics (steep slope and tortuous alignment) none of the tributaries of Kanawha River offer potentialities for development in the interest of modern navigation. Plans for improving the main stream below Charleston (Lock No. 5), which would enable commerce of the character which now plies the Ohio and which will soon be capable of navigating the upper Kanawha, to proceed through that section without reduction in draft have been investigated pursuant to an item included in the River and

Harbor Act of January 21, 1927. The reports on this investigation have now been transmitted to Congress (printed in House Doc. No. 31, 73d Cong., 1st sess.) and the Chief of Engineers recommended therein the provision of a channel depth of 9 feet throughout the lower river by the construction of a dam near Winfield, W. Va., in Kanawha River and a dam in the Ohio River near Gallipolis,
3436 Ohio. The total cost of these improvements (with twin locks 56 by 360 feet at the Winfield Dam and two locks, one 110 by 600 feet and the other 110 by 360 feet at the Gallipolis Dam) are estimated at $12,200,000, a part of which cost is chargeable to Ohio River improvement. When these recommended navigation structures are completed, first-class facilities will be available throughout practically the entire length of Kanawha River and no further navigation improvements therein need be considered at present. The possibilities of power development in connection with existing and proposed navigation dams is considered under the heading "Power development."

## Power development

6. Water-power situation.—On account of the precipitous gradients of the stream and the abundant water supply, the water-power resources of Kanawha Basin rank among the foremost in the eastern United States. Much of this natural power is capable of economic development when legal difficulties can be overcome and a suitabile market exists. At present there are four existing developments of commercial importance in operation in the basin. These are the Kanawha Falls plant at the head of the main stream and the Buck, Byllesby, and Washington Mills plants on upper New River. These plants have a total installed capacity of about 45,000 horsepower. A hydroelectric project known as the "Hawks Nest development" is now under construction near the mouth of New River. This plant will have an initial installation of 140,000 horsepower and an ultimate capacity of 175,000 horsepower.

7. Plan of water-power development.—The district engineer has outlined a general plan for developing the water-power resources of the basin. This plan involves 24 existing and proposed straight waterpower projects and the development of run-of-stream power at 1 proposed and 2 existing navigation dams. The general features of this plan are summarized in the following table:

| Name of project or existing plant | Gross head (feet) | Usable storage at site (acre-feet) | Installation in horsepower | Annual output in million kilowatt-hours | | Estimated cost of development | Cost prima energ (mil per k owat hour |
|---|---|---|---|---|---|---|---|
| | | | | Primary | Secondary | | |
| Moores Ferry | 170 | 584,300 | 99,200 | 147.9 | 14.5 | $11,764,000 | [1] 6. |
| Washington Mills [3] | 47.5 | | 24,400 | 43.8 | 7.6 | 2,494,000 | 5. |
| Fries Junction | 61 | | 81,200 | 56.5 | 12.7 | 2,484,000 | 3. |
| Byllesby [3] | 117 | | 58,200 | 98.3 | 27.9 | 5,377,000 | 5. |
| Foster Falls | 45 | | 24,000 | 43.3 | 18.0 | 2,047,000 | 4. |
| Sayer | 110.4 | 105,000 | 27,300 | 19.1 | 5.2 | 3,848,000 | [1] 15. |
| Barren Springs | 40 | | 28,000 | 46.2 | 17.7 | 1,893,000 | 4. |
| Allisonia | 190 | 190,000 | 28,200 | 42.7 | 7.6 | 7,028,000 | [1] 12. |
| Radford | 115 | 40,000 | 120,000 | 159.3 | 62.3 | 6,865,000 | [1] 3. |
| Whitethorn | 30 | | 25,500 | 45.6 | 25.2 | 2,509,000 | 5. |
| Series of low-head projects on New River | 96 | | 75,000 | 136.0 | 75.0 | 7,500,000 | 5. |
| Pearisburg | 150 | 290,000 | 52,500 | 34.0 | 7.8 | 4,952,000 | [1] 11. |
| Series of low-head projects on New River | 70 | | 65,000 | 118.6 | 61.3 | 6,500,000 | 5. |
| Bull Falls | 115 | 146,300 | 158,800 | 219.7 | 136.6 | 9,967,000 | [1] 4. |
| Hinton | 40 | 20,300 | 67,500 | 81.0 | 56.8 | 5,303,000 | [1] 5. |
| Sandstone | 36 | | 51,200 | 87.0 | 78.7 | 3,815,000 | 3. |
| Series of low-head projects on New River | 459 | | 558,000 | 1,003.2 | 970.3 | 55,800,000 | 4. |
| Hawks Nest [3] | 163 | | 162,000 | 381.9 | 394.8 | 10,835,000 | 2. |
| Gauley Mills | 240 | 80,000 | 25,500 | 39.4 | 3.8 | 6,054,000 | [1] 12. |
| Kree | 165 | | 17,000 | 28.0 | 7.1 | 3,298,000 | 9. |
| Brocks Bridge | 250 | 82,600 | 59,400 | 82.7 | 45.9 | 8,995,000 | [1] 8. |
| Belmont | 270 | | 52,800 | 88.1 | 69.9 | 6,400,000 | 6. |
| Gauley No. 1 | 517 | 11,600 | 134,400 | 194.4 | 216.0 | 8,581,000 | [1] 3. |
| Kanawha Falls [3] | 36.4 | | 43,000 | 104.4 | 112.8 | 3,600,000 | 3. |
| London [4] | 24 | | 25,600 | 66.0 | 43.7 | 2,560,000 | 4. |
| Marmet [4] | 24 | | 25,600 | 63.4 | 42.4 | 2,560,000 | 4. |
| Winfield [4] | 28 | | 30,000 | 76.5 | 48.5 | 3,000,000 | 4. |
| Total | 3,609.3 | 1,550,500 | 2,070,100 | 3,505.0 | 2,370.2 | 196,029,000 | 4. |

[1] At plant switchboard, 30-percent load factor, secondary power credited.
[2] Cost of energy at these plants would be reduced if an equitable charge for regulation were ma against downstream power plants. Conversely, the cost of energy at all other plants would be creased.
[3] Existing project or project under construction. (Byllesby includes Buck plant.)
[4] Power-navigation projects.

8. Economics of power development.—As shown in the abov table, the average unit cost of primary power at the switchboard of the plants included in this plan would be about 4.6 mills pe kilowatt-hour at 30 percent load factor. The district enginee estimates the cost of producing equivalent energy by stea
3438 generation at 7.5 mills per kilowatt-hour, which indicat that the plan as a whole would be economical of develop ment under the assumptions made. In my opinion many of thes power projects will be developed as the power market in the regio expands, if their installation is not hampered by too many legu restrictions. Because of the beneficial effect of storage powe projects on stream regulation, I believe that this type of develop ment should be encouraged by both local interests and the Federa Government.

## Local flood control

9. Flood situation.—The Kanawha Basin is subject to destru tive floods. Overflows in the valley of the main stream and th lower tributaries are the result of both backwater from the Ohi River and of heavy run-off in the basin. As these two types o

floods are not generally coincident, the lower valley is more frequently subject to damage than the upper basin. After a consideration of all the various elements entering into the flood problem, the district engineer concludes that reasonable estimates of the average annual flood damage are $800,000 for the main valley and $200,000 for the tributary valleys.

10. Local flood-control plan.—Because of the narrowness of the affected bottom lands, flood protection by local measures appears impracticable in Kanawha Basin except possibly at a few isolated localities nor could substantial relief be secured through channel improvements. In consequence, the district engineer has presented a system of four reservoirs for local flood control. The principal features of this reservoir system are given in the following table:

| Reservoir | Drainage area (square miles) | Stream | Capacity (acre-feet) | Estimated cost | Cost per acre-foot |
|---|---|---|---|---|---|
| Big Bend | 1,638 | Greenbrier River | 126,500 | $3,670,000 | $29.01 |
| Bluestone | 4,565 | New River | 581,400 | 7,800,000 | 13.42 |
| Clendenin | 1,152 | Elk River | 160,640 | 6,350,000 | 40.77 |
| Summersville | 686 | Gauley River | 315,000 | 8,840,000 | 28.07 |
| Total | 8,041 | | 1,183,540 | 26,860,000 | 22.70 |

3439 The district engineer states that this reservoir system would have been capable of reducing all headwater floods which have occurred in the main Kanawha during the past 71 years below the "no damage line." However, those floods which have been occasioned by Ohio River backwater would have been but little affected. He estimates that the annual charge necessary to amortize the construction cost of this reservoir system in 30 years (with interest at 5 percent) plus the annual cost of operation and maintenance would amount to about $1,870,000. Inasmuch as the resulting benefits would be chiefly to the main valley and but a small part of the tributary flood damage would be alleviated, the district engineer does not believe that the average value of the reservoir plan would exceed $800,000 annually. As its annual cost would be more than twice that amount, he concludes that the plan would be uneconomical.

11. Views of the division engineer.—The flood problem in Kanawha Basin is more serious than is generally recognized by local interests. The greatest flood of record at Charleston occurred in 1861 when a stage of 47 feet was attained. Since that date there have been but three floods above 40 feet, and all of these occurred prior to 1900. Since these large overflows there has been much development along the streams and numerous encroachments in the nature of fills for railroads and industries so that the 1861 flood would, under present conditions, reach a much greater height. In my opinion, local interests should carefully consider this situation when constructing new improvements.

### Flood-water reservoirs

12. Suggested reservoir system.—In compliance with the provisions of section 10 of the Flood Control Act of May 15, 1928, the district engineer has considered the possibilities offered for the use of reservoirs in the Kanawha Basin for the control of its flood waters with the primary purpose in view of alleviating floods on the lower Mississippi River. He suggests a system of four reservoirs for this purpose, the principal features of which are indicated in the following table:

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| Reservoir | Stream | Miles from Mississippi River | Drainage area above dam | Gross capacity | Reservoir area | Estimated cost | Cost per acre-foot |
|---|---|---|---|---|---|---|---|
| | | | *Square miles* | *Acre-feet* | *Acres* | | |
| Poca | Pocatalico River | 757.3 | 345 | 202,000 | 6,300 | $3,560,000 | $17.64 |
| Summersville | Gauley River | 867.1 | 686 | 315,000 | 3,940 | 8,840,000 | 28.07 |
| Bluestone | New River | 877.3 | 4,565 | 918,700 | 10,500 | 13,800,000 | 15.02 |
| Clendenin | Elk River | 796.8 | 1,152 | 160,640 | 3,600 | 6,550,000 | 40.77 |
| Total | | | 6,748 | 1,596,340 | 24,340 | 32,750,000 | 20.50 |

13. Effect of reservoir system.—These reservoirs, if operated primarily for decreasing contributions to flood discharges in the Mississippi River during the danger period at Cairo, would have reduced such contributions on the average during past floods from 23,600 to 10,500 cubic feet per second, indicating an average stage reduction varying from about 0.3 to 0.1 of a foot. In addition, the district engineer states that they would result in local flood control benefits, worth possibly $100,000 annually and would be capable of increasing the minimum flow of the lower Kanawha River by about 1,400 cubic feet per second. Incidental benefits to power development and to Ohio River flood relief would also be obtained. He is of the opinion, however, that the total benefits received from this reservoir system would be incommensurate with its cost. I concur in his opinion.

### Irrigation

14. Need for irrigation.—There is ordinarily ample rainfall for all crops grown in Kanawha Basin, hence irrigation is not practiced.

### Comprehensive plan of development

15. Suggested plan.—In compliance with the spirit of the laws authorizing these surveys and based on the studies outlined above, the district engineer presents a comprehensive plan for the development of navigation in the Kanawha Basin in combination with power and flood control. This plan consists of:

3441 (a) The development of navigation on the Kanawha River by construction of three locks and dams in that stream and one in the Ohio River as has been outlined above under the heading "Navigation."

(b) The development of 24 straight power projects (including 4 existing plants) and 3 navigation-power projects at existing and proposed navigation dams on Kanawha River all as outlined above under the heading "Power development."

16. Effects and benefits of plan.—The district engineer states that the effects and benefits of this comprehensive plan of development would be as follows:

(a) It would provide a dependable 9-foot navigable channel from the Ohio River to the vicinity of Kanawha Falls at the head of Kanawha River.

(b) It would produce economical hydroelectric power up to a maximum of over two million horsepower.

(c) It would increase the minimum low-water flow of Kanawha River by about 4,000 cubic feet per second with resultant benefits to water supply, navigation, and power development below.

(d) It would provide incidental benefits to local flood control on the New, Gauley, and Kanawha Rivers with an average value estimated at about $300,000 annually. It would also benefit flood conditions on the Ohio and Mississippi Rivers to a slight extent.

Conclusions and recommendations

17. District engineer's conclusions.—After giving due consideration to all the problems involved in Kanawha River Basin in connection with navigation, water power, flood control, and irrigation, the district engineer substantially reaches the following principal conclusions:

(a) That improvement of existing navigation facilities in Kanawha River as now authorized and recommended should be prosecuted to early completion.

(b) That development of large amounts of hydroelectric power in Kanawha Basin appears economically feasible when a suitable market exists.

(c) That a comprehensive plan for local flood control alone is not economically justified.

(d) That the control of the flood waters of the basin in the primary interest of Mississippi flood relief would not result in benefits commensurate with its cost.

(e) That irrigation is not practical nor needed in this region.

(f) That the best plan for the ultimate development of Kanawha Basin for the purpose of navigation in combination with power development and flood control is the plan outlined above

under the heading "Comprehensive plan of development" but that Federal participation in this plan appears to be justified only in the case of proposed navigation structures.

18. District engineer's recommendation.—The district engineer recommends that the plans as set up in his report for
3442 navigation improvement and for power development be adopted as a general guide for the future development of Kanawha Basin for these purposes, subject to such later modification as may be found necessary.

19. Views of the division engineer.—The natural resources of the Kanawha watershed are varied and great. This abundance of raw materials coupled with cheap fuel and water power has already led to the establishment of a sizeable industrial district along the main stream and with improvement of navigation facilities therein as now authorized, it is certain that more manufactories will locate in this valley. Topographic conditions and the location of transportation facilities (both land and water) necessitate that any industrial development must take place in or adjacent to the flood plain of the stream with resulting serious encroachment on the natural floodway. Such development has and will greatly enhance the need for flood protection and stream regulation. In view of these facts I do not believe that the justification for flood control reservoirs in Kanawha Basin can be based on present potential damages and past flood stages. (See par. 11 above.) It is my view that some degree of flood protection and stream regulation is worthy of serious consideration.

20. The district engineer has proposed a system of reservoirs for local flood control which he states would have reduced all headwater floods of past record at Charleston below the "no-damage line." Of the four reservoirs he has included in this plan, the cheapest and most effective reservoir is one termed the "Bluestone Reservoir" located on New River immediately below the mouth of Bluestone River and above the junction of Greenbrier River. The pool formed by the proposed dam would be located in both the States of West Virginia and Virginia. This reservoir, as planned by the district engineer, would have a gross storage capacity of about 580,000 acre-feet and would control about 4,565 square miles of watershed, or one-half the total area above Charleston and over one-third of that of the entire Kanawha Basin. Its cost is roughly estimated at $7,800,000,
3443 or $13.42 per acre-foot of gross capacity. Based on figures given in the district engineer's report I estimate that the local flood control benefits of this reservoir alone would exceed $300,000 annually which, if capitalized at 5 percent, would amount to $6,000,000, or almost enough to justify the construction of the project.

21. The Louisville district of this division has been charged with the preparation of a comprehensive report on the Ohio River Basin as a whole which will be submitted at an early date. This report will present among other plans, a modified reservoir system for Ohio River flood relief, which, on the basis of preliminary figures, is on the borderline of feasibility. Bluestone Reservoir is included in this system and so may be expected to result in appreciable benefits to Ohio River flood control.

22. The ultimate plan of development outlined by the district engineer does not include any reservoir for local, Ohio, or Mississippi flood relief, but does include certain power reservoirs which are apparently feasible. Among these power reservoirs are two which he has termed the "Bull Falls" and "Hinton" developments. These projects would provide about 167,000 acre-feet of usable storage and would develop a total gross head of 185 feet. The proposed Bluestone flood-control reservoir would eliminate these two power developments, but I see no reason why this should be a drawback to the project considering the abundance of water power in this region and the fact that this reservoir could be constructed and operated in such a manner as to develop water power and provide stream regulation incidental to flood control. It is my opinion that the power privilege at the Bluestone Reservoir would be worth a considerable sum, thus reducing its cost to other interests.

23. In view of the magnitude of the benefits, both direct and indirect, which would apparently result from the construction of the Bluestone Reservoir, I regard it as an undertaking worthy of serious consideration. Because of the widespread character of these benefits and the interstate nature of the development, I believe that a project at this site might be suitable for construction by the United States under the provisions of the National Recovery Act if found feasible from an engineering standpoint.

3444 24. Recommendation.—With a view to determining its engineering feasibility I recommend that immediate authority be given to proceed with further investigation of the Bluestone Reservoir project including surveys, borings, and preparation of detail plans and estimates at an estimated cost of $50,000.

25. I further recommend that the report of the district engineer be accepted as a compliance with the acts authorizing these surveys, and that it be printed in order that the data contained therein, collected at Federal expense, may be made available to the general public.

GEO. R. SPALDING,
*Colonel, Corps of Engineers, Division Engineer.*

(First indorsement)

OFFICE PRESIDENT MISSISSIPPI RIVER COMMISSION,
*Vicksburg, Miss., December 9, 1933.*

TO CHIEF OF ENGINEERS, UNITED STATES ARMY:

1. From a consideration of the report on the Kanawha River, W. Va., Va., and N. C., the Mississippi River Commission concludes that—

(a) The needs of present and prospective navigation will apparently be sufficiently provided for when the previously authorized and recommended navigation structures in the Kanawha River are completed.

(b) The general plan outlined by the district engineer for developing the water-power resources of the Kanawha River basin as a whole appears to provide for an economical development, under which it is believed many of the power projects will be developed by private interests as the power market in the region expands.

(c) There is no need for irrigation.

(d) The effect of the construction of storage reservoirs in the basin of the Kanawha River on the flood heights of the Mississippi River at Cairo would be a possible average stage reduction varying from three-tenths to one-tenth of a foot in the stages of the major floods. However, the cost of this reduction would be relatively very high.

(e) Flood control in the basin of the Kanawha River may best be accomplished by means of one or more reservoirs. Under present conditions it appears that the greatest benefits would accrue from the construction of the Bluestone Reservoir, if it should be found feasible from an engineering standpoint.

2. The Mississippi River Commission recommends that the report be published for the benefit of those interested.

For the Mississippi River Commission:

H. B. FERGUSON,
*Brigadier General, Corps of Engineers, President.*

3444-A REPORT OF THE DISTRICT ENGINEER

Syllabus

Navigation.—The existing project on the Kanawha River consists of 10 locks and dams and provides a 6-foot navigable depth. Four of these in the upper river above Charleston are being replaced by two new, high-lift locks and dams providing larger locks with a 9-foot navigable depth as authorized by the Rivers and Harbors Act of July 3, 1930. This modification should be extended to include the lower river from Charleston to its mouth, as the present navigation facilities are inadequate to serve an

active and growing commerce. No navigation exists or can be expected on any of the tributaries.

Water power.—The two principal tributaries of the Kanawha River, the New and Gauley Rivers, rank high in national importance with regard to their water-power resources. A number of power developments have been proposed on those streams and their construction will probably be made when economic and legal conditions permit. Other tributaries of the Kanawha River offer little or no possibilities for feasible power developments of commercial importance. The proposed new navigation dams on the Kanawha River are suitable for economic water-power development in conjunction with their use for navigation.

Flood control.—The Kanawha River Basin is subject to destructive floods. The principal regions of damage are along the main stream and in the valleys of a number of the minor tributaries. Backwater from the Ohio River causes flood damage in the lower part of the basin and no economical measures of relief are possible to prevent this damage. A plan for local flood control is presented involving the construction of four reservoirs to protect the greater part of the Kanawha River main valley from destructive floods. This plan, which is considered the best obtainable, is not economically justified. A system of reservoirs is presented for the benefit of flood control on the lower Mississippi River.

Irrigation.—Irrigation is not practiced nor is there a need for it in the Kanawha River Basin.

General.—The improvement of existing navigation facilities by the United States appears justified. The development of large amounts of hydroelectric power on the headwater tributaries appears feasible but no Federal participation in such works would be justified. It would not now be economical for any agency to construct works solely for flood control, but some form of local cooperation appears justified in connection with power storage for its incidental flood relief benefits.

3444–B

WAR DEPARTMENT,
UNITED STATES ENGINEER OFFICE,
*Huntington, W. Va., October 15, 1932.*

Subject: Report on the Kanawha River, W. Va., Va., and N. C.
To: The division engineer, Upper Mississippi Valley division, St. Louis, Mo.

## Reports

1. Authority.—This report on the Kanawha River, W. Va., Va., and N. C., is submitted in compliance with the provisions of House Document No. 308, Sixty-ninth Congress, first session, which was enacted into law with modifications, in Section I of the River and

Harbor Act approved January 21, 1927; and under the provisions of Section 10 of the Flood Control Act of May 15, 1928, for the control of floods on the Mississippi River and tributaries.

2. Scope and purpose.—This report on the Kanawha River and its tributaries embraces a study of the possibilities of improvement for the purposes of navigation, water power development, flood control, and irrigation; also the possibility of coordinating any or all of these various uses.

* * * * * *

3444–C 4. Previous reports on New River.—A survey of 54 miles of the New River between Sinking Creek and Greenbrier River was made by Moore and Briggs in 1819 under the auspices of the Board of Public Works of the State of Virginia, with a view of connecting the waters of the James and Kanawha Rivers by that route. They reported:

The fall in this part of the river, considering the mountainous country it passes through, is comparatively moderate. The principal falls are the Bull Falls, McDaniels, Andersons, Wileys, Neilleys, and Peters Mountain Falls—none which has been improved in the least degree, yet we ascended them all with our boat, though in two or three instances with considerable difficulty, after taking out baggage, stores, etc. (Annual Report of the Chief of Engineers, p. 843, 1873.)

A report on the examination of New River from the mouth of Greenbrier River, W. Va., to the lead mines in Wythe County, Va. (H. Ex. Doc. 25, 42d Cong., 3d sess., or pp. 78, 842 to 854, Annual Report of the Chief of Engineers, 1873), was submitted in January 1873, to comply with the River and Harbor Act of June 10, 1872. This report recommended two plans of improvement for consideration—a 2-foot bateaux navigation project costing about $100,000 and a 3-foot steamboat navigation project costing about $1,000,000. An estimate of $2,500,000 was given as the approximate cost for 5½-foot steam navigation. The first plan of improvement was approved August 14, 1876. The extension of this improvement from the lead mines in Wythe County, Va., to the mouth of Wilson Creek, in Grayson County, Va., was provided by act of Congress of June 14, 1880 (pp. 133–139, pt. 2, Annual Report of the Chief of Engineers, 1875, and pp. 538–549, pt. 1, Annual Report of the Chief of Engineers, 1879, or S. Ex. Doc. 41, 45th Cong., 3d sess).

In 1891 it was reported that further improvement of the river was unnecessary, the conditions having changed in later years. A report was submitted on that part of the river near its confluence with the Greenbrier River, W. Va., which recommended that the river in that vicinity was "not worthy of improvement" by slack-water navigation (H. Doc. 176, 58th Cong., 2d sess., or

p. 477, pt. 1, and pp. 2617–2620, pt. 3 of the Annual Report of the Chief of Engineers, 1904). A report was also submitted on the section of the river between Radford, Va., and Hinton, W. Va., which recommended that it was "not worthy of improvement" by slack-water navigation (H. Doc. 1410, 62d Cong., 3d sess., or p. 1023, pt. 1, Annual Report of the Chief of Engineers, 1913). The sum of $109,691.06 was expended up to June 30, 1898, on the New River for open-river navigation. No work has been done on the stream since 1899, and it is probable that the channels have become obstructed considerably since they were last improved.

* * * * * * *

3444–D 7. Previous reports on Greenbrier River.—A report was submitted on the improvement of the Greenbrier River, based upon a preliminary examination made in 1884, and published as House Document No. 71, Forty-eighth Congress, Second session. The conclusion of this report was that, 'The river is not navigable and the portion of the New River below its mouth is also unnavigable.' The expressed opinion of the reporting officer was that the Greenbrier River 'is not worthy of improvement by the General Government.' This report also makes reference to a previous report appearing on page 675, part 1, Annual Report of the Chief of Engineers, 1877. This earlier report presents a lengthy discussion of the possible improvements of the Greenbrier River, or part of it, by a slack-water system from its mouth to the mouth of Howards Creek, with a view to its use as a link in the proposed Kanawha-

3444–E James River Canal Project. Twenty-nine dams and thirty locks with average lift of 10 feet to provide a 7-foot navigable depth, were recommended for this section of the river at a total cost of $6,251,290. The complete project contemplated the connection of "the waters of the James and the Ohio Rivers by a water-navigation of 7-foot depth" and, in a resolution of March 18, 1874, by the Board of Engineers, was declared to be, in its opinion, "entirely practicable." No record is available to show that the project was ever definitely recommended for adoption by Congress.

III. Physical characteristics and natural resources

8. General description of Kanawha River.—The Kanawha River is formed by the junction of the New and Gauley Rivers in southwestern West Virginia and flows in a northwesterly direction for its length of 97 miles to the Ohio River, which it joins at Point Pleasant, W. Va., 266 miles below Pittsburgh, Pa. The Kanawha River Basin lies between those of the Guyandot and Little Kanawha Rivers. The main stream is wholly in the State

of West Virginia but its total watershed area of about 12,300 square miles also drains considerable portions of Virginia and North Carolina. A general map of the watershed is shown on exhibit no. 1, facing page 92 of this document. From its source at elevation 652 to its mouth at elevation 514.7 (both low-water elevations), the Kanawha River has a total fall of 137.3 feet or an average slope of 1.41 feet per mile. About 1½ miles below the head of the river, at a point known as "Kanawha Falls", the river drops almost vertically about 15 feet. The average natural slopes of the Kanawha River are as follows:

| | Feet per mile |
|---|---|
| From head of river to below Kanawha Falls (2 miles) | 14.48 |
| From below Kanawha Falls to Paint Creek (14.5 miles) | 2.81 |
| From Paint Creek to Lock No. 10 (61.3 miles) | .99 |
| From Lock No. 10 to its mouth (19.2 miles) | .37 |

The river banks are fairly high, ranging from 40 to 55 feet above low water. The width of the river at normal stage is from 500 to 800 feet. The controlling depth of the river over the bar at Charleston during low water is 6 feet, at extremely high water is 42 feet, and at mean stage is approximately 20 feet. At Lock No. 2, at Montgomery, W. Va., 12 miles below the head of the river, the difference between high and low water is 31 feet. The minimum flow of record at this lock, which occurred in 1930, is 841 second-feet. The maximum flow is about 275,000 second-feet and the average flow about 12,500 second-feet. At the mouth of the Kanawha River the minimum flow is about 900 second-feet, the maximum about 255,000 second-feet and the average flow about 18,000 second-feet. Exhibit no. 2 con-
3444-F tains a profile of the Kanawha River with the proposed and existing navigation improvements shown thereon. The principal tributaries of the Kanawha River, main stream, together with their drainage areas are listed in the following table:

| Stream | Point | Area | Mile |
|---|---|---|---|
| Kanawha River | At mouth | 12,300 | 0 |
| Pocatalico River | do | 359 | 30.0 |
| Coal River | do | 880 | 46.0 |
| Elk River | do | 1,540 | 58.0 |
| Kanawha River | Charleston (gaging station) | 8,880 | 58.1 |
| Do | Lock No. 2 | 8,470 | 84.8 |
| Do | Junction New and Gauley Rivers | 8,358 | 97.0 |
| New River | At mouth | 6,918 | 97.0 |
| Gauley River | do | 1,440 | 97.0 |

A general map of the Kanawha River Basin, showing the principal tributaries and their drainage areas, is given on exhibit no. 6.

9. *General description of the New River.*—The New River rises in northwestern North Carolina near the Tennessee line, flows northeasterly into Virginia through and between spurs of the

Blue Ridge Mountains, parallel to the main divides of this ridge and the Alleghenies, until it reaches a point known as the "Horseshoe" near Little River, whence it turns abruptly to the northwest, breaking through the five ranges into which the Allegheny Mountains are here divided, and keeping the same general direction to its mouth at the confluence with the Gauley River where the Kanawha River is formed. From its source at about elevation 3,800 to its mouth at elevation 652, the New River has a total fall of 3,148 feet in its length of about 341 miles, or an average slope of 9.2 feet per mile. The average natural slopes of the New River are as follows:

| | Feet per mile |
|---|---|
| From the source of the South Fork to the junction of the forks (86.4 miles) | 15.1 |
| From the source of the North Fork to the junction of the forks (41.5 miles) | 31.5 |
| From the junction of the forks to Washington Mills (48.2 miles) | 6.5 |
| From Washington Mills to the Wythe-Carroll County line (13.8 miles) | 15.2 |
| From the Wythe-Carroll County line to the mouth of the Greenbrier River (128.9 miles) | 4.8 |
| From the mouth of the Greenbrier River to the mouth of the New River (64.1 miles) | 11.1 |

Profiles of the New River and its principal tributaries are shown on exhibit no. 3, printed facing page 92 of this document. The channel of the New River is, in general, narrow and tortuous with numerous rapids and falls, since its course lies almost entirely in a rugged mountainous region. The stream follows deep, narrow, valleys formed by the long parallel folds typical of the Allegheny Mountain system. Many steep bluffs frequently rise sheer from the river's edge. The river at a point about 10 miles below Hinton, W. Va., enters a gorge, the channel being narrow and the gradient steep for about 50 miles. The river abruptly leaves the gorge a short distance above its mouth. The width of the New River, main stream, varies from about 200 feet to 1,000 feet, averaging about 500 feet. At low water its depth varies from about 2 feet to about 6 feet. Innumerable ledges composed of slate, sandstone, or limestone cross the stream creating waterfalls varying in height from less than 1 foot to about 18 feet. Bars composed of sand, gravel, and bowlders also produce waterfalls or rapids at numerous points along the stream. Between these ledges and rapids there may be either rapids or short shallow pools, although in some instances there occur longer and deeper pools. The following are the approximate variations in stream discharge at the mouth of the New River:



| | Cubic feet per second |
|---|---|
| Minimum flow | 836 |
| Maximum flow | 280,000 |
| Average flow | 10,100 |

The principal tributaries of the New River together with their drainage areas are listed in the following table:

| Stream | Point | Area | Mile |
|---|---|---|---|
| | | Sq. mi. | |
| New River | At mouth | 6,918 | 0 |
| Greenbrier River | do | 1,653 | 64.1 |
| Bluestone River | do | 452 | 67.4 |
| Wolf Creek | do | 239 | 100.4 |
| Walker Creek | do | 319 | 112.2 |
| Little River | do | 338 | 150.3 |
| Big Reed Island Creek | do | 356 | 173.6 |
| Reed Creek | do | 259 | 179.0 |
| New River | At junction of North and South Forks | 611 | 235.0 |
| North Fork | At mouth | 287 | 235.0 |
| South Fork | do | [illegible] | 253.0 |

* * * * *

3444–H 12. Topography and geology.— * * *

New River, the longest tributary of the Kanawha River, has its source in the Allepheny Mountain province and drains a large portion of the Great Valley. It is formed in the State of North Carolina and has a very steep and irregular gradient from source to mouth. Other principal tributary streams of the Kanawha River are likewise mountainous streams with precipitous courses. The Kanawha River, however, lies in the Ohio Valley and Cumberland Plateau provinces and consequently has a more uniform and flat gradient.

* * * * *

3444–I 25. Transportation facilities.—The industrial growth in the basin has been closely interwoven with the growth of its transportation facilities. In the early pioneer days when the valley was first settled, the only means of transportation were the rivers as no highways or railroads existed in that part of the country. The first commerce on the rivers was carried in keel boats, small hand-propelled barges, and on rafts. In 1823 the first steamboat, the "Eliza," operated on the Kanawha River. It was followed by the "Fairy Queen" in 1824, the "Paul Pry" in 1826, the "Kanawha" in 1828, the "O. H. Perry" and the "Enterprise" in 1830, the "Tiskelwah" in 1832, and many others after this latter date. By 1835 the Kanawha Valley was taking a prominent part in the great steamboat era. In 1831 the James River and Kanawha Turnpike was completed to the Ohio River with its river terminus at Guyandot (now a part of Huntington, W. Va.) where it connected with steamship lines on the Ohio River. A large part of this highway which started from Richmond, Va., had been in use in 1828 and before. For many years it was the most important post road between the Virginia seaboard and the West.

It entered the Kanawha Basin over the divide between the James and Greenbrier Rivers passing through White Sulphur Springs and Charleston.

Until the coming of the railroads in the early seventies, the rivers and highways were the only arteries of commerce. Open channel improvement of the Kanawha River to aid its growing traffic was made previous to 1875 when a project was adopted for the slack-watering of the river by means of 10 locks and dams. This project was completed in 1898 and provided a 6-foot navigable depth from the Ohio River to a point about 90 miles above. At the present time the Kanawha Basin is served by five large railroad systems, a number of improved highways, and the existing navigation project on the main stream. The railroads in the basin are the Chesapeake & Ohio, the New York Central, the Norfolk & Western, the Baltimore & Ohio, and the Virginian. These railroads and their numerous branches reach every point of industrial importance and gather an immense amount of traffic from the hundreds of coal mines of the basin.

* * * * * *

40. History of the existing navigation improvement.— * * *

Funds were expended by the United States for open-channel improvement on the New, Gauley, and Elk Rivers in order to aid the bateaux navigation using those streams in the early days. These expenditures which commenced in 1878 were continued very intermittently to 1902 when they ceased, owing to the practical cessation of commerce by that date on the streams.

3444-J 41. Description of the existing navigation improvement.— * * * Difficulties and delays to navigation are caused also by sand deposits on the dams and in the channel in the lower section of the river, especially in the channel below Locks Nos. 10 and 11. These deposits occur suddenly during freshets and to such an extent that the resulting navigable depth in the channel below Lock No. 10 may be only 2 to 3 feet, while below Lock No. 11 the channel at times is filled completely for a considerable distance. As much as 50,000 cubic yards of deposit left during freshets have had to be removed in 1 year from the channel in the lower approach of Lock No. 11.

* * * * * *

61. Proposed power projects.— * * * Of the various proposed projects the Radford and Bluestone projects of the Appalachian Electric Power Co. have received the greatest prominence. These projects are located on the New River some distance below the Buck and Byllesby water-power developments which are owned by the same applicant. This company applied to the

former Federal Power Commission for a license to build and operate a hydroelectric power plant near Radford, Va. (Federal Power Commission project no. 739). A full license was tendered, but the applicant refused to accept it and in turn applied for a minor part license. This the former Federal Power Commission refused to either issue or reject, with a view of having the issue taken to the Federal courts in order to have its jurisdiction over nonnavigable streams which flow into navigable ones determined. However when the present Federal Power Commission came into office, it offered the applicant a standard form license and ordered it not to proceed with construction until it had received and accepted such license. The issue is now pending in the Federal courts to have the extent of the jurisdiction of the Commission over the New River determined.

3444–K

* * * * *

62. Comprehensive scheme of power development of New River Basin.—A general plan is submitted for a comprehensive scheme of power development of the New River Basin. A summary of the projects embraced in this plan is given in table no. 2 of appendix C. Tabulations of the principal data of each project of the general plan are given in tables no. 5 to no. 19, inclusive, of appendix C. The locations of these projects are shown on the map of exhibit no. 32 and the profiles of exhibit no. 3.

As the existing water-power developments (with some necessary modifications) and most of the officially proposed power projects satisfactorily fit into plans for the best utilization of the stream's water-power resources, they are included in the scheme submitted herein. As previously mentioned, this scheme is not intended to include all possible projects in the basin or to be considered as final with regard to details of location, heads, installations, etc., but to formulate a plan as a general guide for the future development of the stream. The general features of the plan are:

1. The inclusion of a large amount of storage, reservoir capacity for stream-flow regulation.

2. The utilization of the regulated flow obtained from the reservoirs through the maximum available head of the river.

3. Sufficiently large installations to enable the development of primary peak power at low load factors.

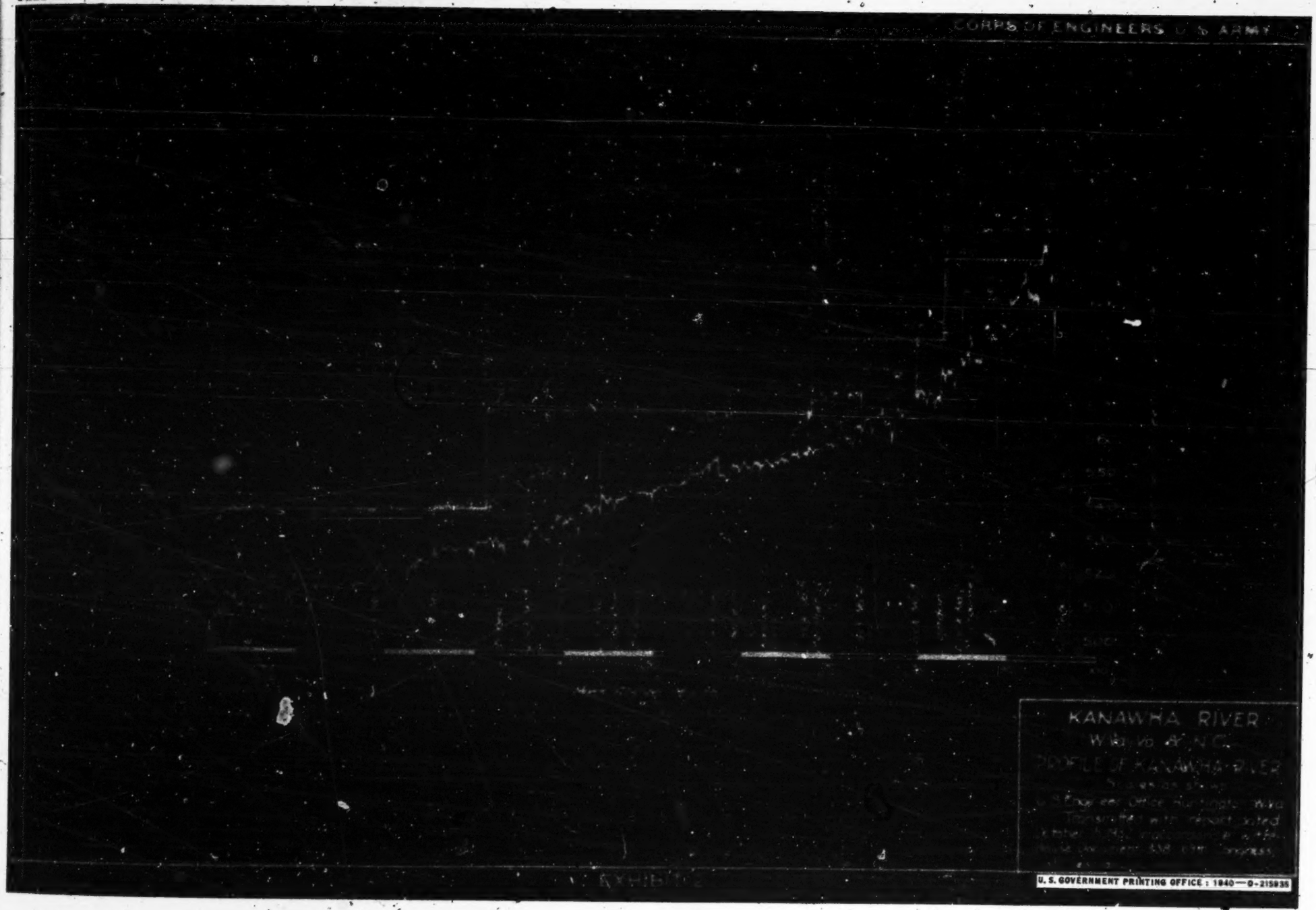
* * * * *

APPENDIX C, TABLE 2.—COMPREHENSIVE SCHEME OF POWER DEVELOPMENT OF NEW RIVER BASIN

| Name of project or existing plant | Stream | Miles above mouth of Kanawha River | Drainage area | Normal elevation | | Head | | Usable storage at site | Cumulative storage | Primary flow at site | Primary power | Primary peak power | Primary output | Secondary output | Total output | Estimated cost of development | Installation in horsepower | Estimated cost per installed horsepower | Estimated cost of primary energy at switchboard | Estimated total annual cost of power | Estimated annual cost of primary energy [1] | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Headwater | Tailwater | Gross | Net | | | | | | | | | | | | | | | |
| | | | *Square miles* | | | *Feet* | *Feet* | *Acre feet* | *Acre feet* | *Cubic feet per second* | *Horsepower* | *Horsepower* | *Kilowatt-hours* | *Kilowatt-hours* | *Kilowatt-hours* | | | | *Mills per kilowatt-hour* | | | |
| Bluestone Mills project | New River | 314.4 | 1,022 | 2,400 | 2,230 | 170 | 150 | 584,300 | 584,300 | 1,530 | 24,327 | 81,090 | 147,908,000 | 14,500,000 | 162,408,000 | $11,761,000 | 99,200 | $118.50 | 6.65 | $990,377 | $983,127 | A. E. P. Co. project. |
| Junction project | do | 304 | 1,140 | 2,215 | 2,167.5 | 47.5 | 46.5 | | 584,300 | 1,550 | 7,200 | 24,000 | 43,822,000 | 7,633,000 | 51,455,000 | 2,494,000 | 24,400 | 102.00 | 5.06 | 225,554 | 221,737 | A redevelopment. |
| project | do | 298 | 1,165 | 2,143 | 2,082 | 61 | 60 | | 584,300 | 1,550 | 9,300 | 31,000 | 56,544,000 | 12,700,000 | 69,244,000 | 2,484,000 | 31,200 | 80.00 | 3.99 | 231,933 | 225,583 | A. E. P. Co. no. 1 project. |
| project | do | 295 | 1,310 | 2,082 | 1,965 | 117 | 102 | | 584,300 | 1,585 | 16,167 | 53,889 | 98,295,000 | 27,900,000 | 126,195,000 | 5,377,000 | 58,200 | 92.70 | 5.12 | 517,314 | 503,364 | Byllesby & Buck projects combine. |
| Falls project | do | 281.5 | 1,540 | 1,950 | 1,905 | 45 | 44 | | 584,300 | 1,620 | 7,128 | 23,760 | 43,338,000 | 18,000,000 | 61,338,000 | 2,047,000 | 24,000 | 85.00 | 4.44 | 201,492 | 192,490 | |
| project | Reed Creek | 278.5 | 258 | 2,015 | 1,904.6 | 110.4 | 95 | 105,000 | 105,000 | 330 | 3,135 | 10,470 | 13,061,000 | 5,200,000 | 24,261,000 | 3,848,000 | 27,300 | 141.00 | 15.45 | 297,009 | 294,400 | |
| Springs project | New River | 275 | 1,806 | 1,905 | 1,865 | 40 | 39 | | 889,300 | 1,950 | 7,605 | 25,340 | 46,238,000 | 17,700,000 | 63,928,000 | 1,893,000 | 26,000 | 73.00 | 4.03 | 195,120 | 186,270 | |
| project | Big Reed Island Creek | 274 | 278 | 2,100 | 1,910 | 190 | 178 | 190,000 | 190,000 | 400 | 7,120 | 24,733 | 42,682,000 | 7,576,000 | 50,258,000 | 7,028,000 | 28,200 | 249.00 | 12.55 | 540,784 | 537,000 | |
| project | New River | 248 | 2,380 | 1,846 | 1,731 | 115 | 104 | 40,000 | 919,300 | 2,520 | 26,229 | 87,360 | 159,345,000 | 62,280,000 | 221,625,000 | 6,865,000 | 120,000 | 57.20 | 3.89 | 650,550 | 619,410 | A. E. P. Co. project. |
| thorn project | do | 231 | 2,806 | 1,716 | 1,686 | 30 | 29 | | 919,300 | 2,585 | 7,500 | 25,000 | 45,579,000 | 25,200,000 | 70,779,000 | 2,509,000 | 25,500 | 98.00 | 5.01 | 238,400 | 225,800 | Howe project. |
| s of Low Head projects | do | 231–209 | 2,936 | 1,686 | 1,590 | 96 | 86 | | 919,300 | 2,600 | 22,150 | 73,830 | 136,695,000 | 75,000,000 | 211,695,000 | 7,500,000 | 75,000 | 100.00 | 5.00 | 717,500 | 680,000 | |
| burg project | Wolf Creek | 209.5 | 319 | 1,740 | 1,590 | 150 | 129 | 290,000 | 290,000 | 420 | 5,547 | 18,380 | 33,966,000 | 7,840,000 | 41,806,000 | 4,952,000 | 52,500 | 94.00 | 11.71 | 491,821 | 397,900 | |
| s of Low Head projects | New River | 209–197 | 3,340 | 1,590 | 1,520 | 70 | 63 | | 1,209,300 | 3,045 | 19,200 | 64,000 | 116,400,000 | 61,300,000 | 177,900,000 | 6,500,000 | 65,000 | 100.00 | 5.00 | 613,650 | 523,000 | |
| Falls project | do | 170.5 | 4,100 | 1,520 | 1,405 | 115 | 104 | 146,500 | 1,355,800 | 3,475 | 36,140 | 120,470 | 219,731,000 | 136,580,000 | 356,311,000 | 9,967,000 | 158,800 | 63.00 | 4.13 | 976,845 | 908,555 | A. E. P. Co. project. |
| ton project | do | 102 | 4,565 | 1,410 | 1,370 | 40 | 37 | 20,500 | 1,376,300 | 3,600 | 13,325 | 44,400 | 80,986,000 | 56,800,000 | 137,786,000 | 5,303,000 | 67,500 | 78.60 | 5.42 | 467,670 | 439,270 | Do. |
| stone project | do | 151 | 6,273 | 1,320 | 1,274 | 36 | 35 | | 1,376,300 | 4,090 | 14,315 | 47,717 | 87,035,000 | 78,700,000 | 165,735,000 | 3,815,000 | 51,200 | 74.50 | 3.99 | 386,969 | 347,619 | Elec.-Met. Co. project. |
| s of Low Head projects | do | 151–105 | 6,555 | 1,274 | 835 | 459 | 400 | | 1,376,300 | 4,125 | 165,000 | 550,000 | 1,063,200,000 | 970,584,000 | 1,973,784,000 | 55,800,000 | 558,000 | 100.00 | 4.00 | 4,498,392 | 4,013,100 | |
| ks Neck project | do | 105.5 | 6,830 | 815 | 652 | 163 | 151 | | 1,376,300 | 4,160 | 32,816 | 165,000 | 381,921,000 | 394,770,000 | 776,691,000 | 10,835,000 | 165,000 | 65.70 | 2.30 | 1,076,070 | 878,685 | Elec.-Met. Co. project; under construction. |
| Total (New River) | | | 6,218 | | | 2,054.9 | 1,861.5 | 1,376,300 | 1,376,300 | 4,160 | 454,170 | 1,469,440 | 2,762,251,000 | 1,980,263,000 | 4,742,514,000 | 150,981,000 | 1,656,800 | 91.13 | 4.43 | 13,227,441 | 12,237,310 | |

215935—40 (Face p. 2706)

3444-M


CORPS OF ENGINEERS U. S. ARMY
KANAWHA RIVER
EXHIBIT
U. S. GOVERNMENT PRINTING OFFICE : 1940—O-215935

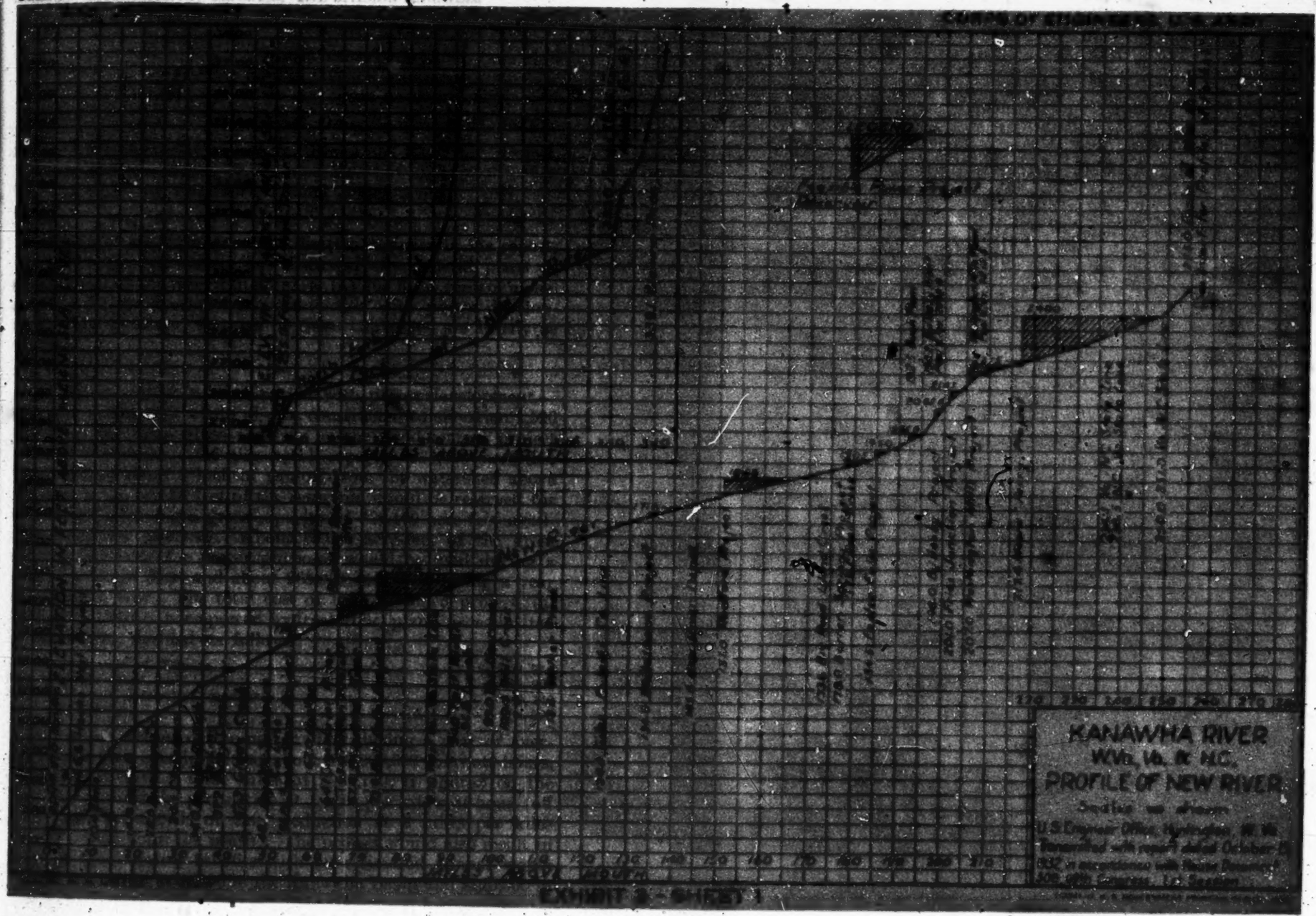



EXHIBIT 3 - SHEET 1

U. S. GOVERNMENT PRINTING OFFICE : 1940—O-310856

3444–N SUPPLEMENTAL REPORT OF THE DIVISION ENGINEER

* * * * *

WAR DEPARTMENT,
OFFICE OF THE DIVISION ENGINEER,
OHIO RIVER DIVISION,
*Cincinnati, Ohio, November 21, 1934.*

Subject: Supplemental report on Bluestone Reservoir project, Kanawha River Basin, W. Va. and Va.
To: The Chief of Engineers, United States Army.

* * * * *

4. Plans of development.—The district engineer in his report, which is appended hereto, has discussed two general plans of development of the reservoir site, i. e, (a) for flood control alone, and (b) for flood control in combination with power development. The principal features of these two plans are briefly as follows:

* * * * *

(b) Flood control in combination with power development.—The dam in this case would also be constructed to elevation 1,520 providing the same gross capacity as the flood-control project (625,600 acre-feet). Of this total capacity 235,500 acre-feet (representing about 1 inch of run-off from the watershed above the site) in the top 30 feet of the reservoir would be reserved for flood control, leaving a gross capacity of 390,100 acre-feet available for power purposes. About 65,000 acre-feet of the gross capacity available for power purposes would be used during a year of average flow, and about 268,000 acre-feet during a year of minimum flow. The total cost of this combined project, including a 120,000 horsepower hydroelectric plant, is estimated at $12,942,390, divided as follows:

| | |
|---|---|
| Construction cost of dam | $8,004,750 |
| Cost of power plant | 3,680,000 |
| Relocations and protection measures | 349,140 |
| Land and damages | 908,500 |

The annual output of the power plant during a year of average stream flow is estimated at about 403,000,000 kilowatt-hours, which would have a total value of $939,750, if figured on the basis of one-third the production at 1 mill per kilowatt-hour (off peak) and two-thords of the production at 3 mills per kilowatt-hour (on peak). The project would also result in
3444–Q flood-control benefits with an estimated annual worth of about $250,000 in the Kanawha Basin and $120,000 in

the Ohio Valley. The flood-control benefits and power revenue accruing from this plan would therefore total approximately $1,309,750, which, when compared with an annual cost of $726,296 (including interest, operation, and maintenance but no provision for amortization of the expenditures made for the dam and reservoir) indicates a ratio of cost to benefits of 1 to 1.8.

* * * * *

8. The plan of development recommended by the district engineer proposes a combined flood control and power project in which the flood control capacity provided would be reduced from 581,400 acre-feet, proposed in the Ohio River flood-control plan, to 235,000 acre-feet. (In this connection it might be noted that neither plan contemplates provision of flood storage in the amount required to reduce the maximum probable flood at the dam site below the 'no damage' stage). This proposed reduction in flood storage capacity apparently would reduce the flood-control benefits of the plan by approximately one-half. However, to offset this, annual power revenues in the amount of over $900,000 would be realized from the project recommended by the district engineer. Capitalizing these annual power revenues at 8 percent indicates a justified contribution by power interests of approximately $11,250,000 to the project on the basis of its power value alone. This is exclusive of its indirect benefits to existing and potential water-power plants below, and the possibility of further increase in value of the Bluestone plant due to projects built above it. It thus appears that the flood-control benefits of the plan will ultimately, upon development of a suitable market for the power produced, accrue practically free of any cost. The combined development, therefore, appears the most attractive.

* * * * *

R. G. POWELL,
*Lieutenant Colonel, Corps of Engineers,*
*Division Engineer,*

* * * * *

3444–P SUPPLEMENTAL REPORT OF THE DISTRICT ENGINEER

Syllabus

Flood control.—The report on Kanawha River made under the provisions of House Document No. 308, Sixty-ninth Congress, first session, presented a reservoir plan for comprehensive flood relief in the Kanawha Valley. The plan consisted of a system

of 4 reservoirs, 1 each on 4 tributaries of Kanawha River. The Bluestone Reservoir on New River appeared to have greater possibility of economic justification than any other in the system, in that it has practically the same storage capacity and controlled more drainage area than the other three combined and showed a much smaller cost per acre-foot. Bluestone Reservoir alone cannot provide the complete flood relief that the entire system would afford, but studies indicate that the measure of relief it would give makes it an economically justifiable project.

Water power.—For more than 30 years, the potential value of the water-power resources of the New River has been recognized by power companies. Three water-power plants are in operation on the stream and another of large capacity is approaching completion. A number of other power projects have been proposed, several of which will probably be constructed when legal and economic conditions permit. The Bluestone site occupies the most important position among the sites that have been proposed. A power company has made a thorough investigation of foundation conditions; has surveyed and mapped the reservoir area; and has acquired the dam site and a large part of the flowage in the reservoir.

Flood control and power development combined.—By the operation of Bluestone Reservoir alone, it is not practicable to reduce below danger stage all of the floods in Kanawha River. In some cases the New River contribution is not sufficient to reduce flood heights below the danger stage at Charleston; the lower Kanawha cannot be protected from backwater of Ohio River floods by reservoir control of New River floods. The inclusion of power development in the project will not seriously reduce the efficiency of the reservoir for controlling floods.

WAR DEPARTMENT, UNITED STATES ENGINEERS OFFICE,
*Huntington, W. Va., July 31, 1934.*
(Revised Nov. 19, 1934.)

Subject: Supplemental report on the Kanawha River, W. Va., Va., and N. C. (Bluestone Reservoir project).
To: The division engineer, Ohio River Division, Cincinnati, Ohio.

* * * * * *

3444-Q 4. Previous reports on New River—

| | Congressional document | | | | Annual Report of the Chief of Engineers | |
|---|---|---|---|---|---|---|
| | House or Senate | No. | Congress | Session | Year | Pages |
| 1. Survey of 1819 by Moore and Briggs, Greenbrier River to Sinking Creek. | | | | | | |
| 2. Survey from Greenbrier River to lead mine in Wythe County, Va. | House | 25 | Forty-seco. d | Third | 1873 | 78, 842-854 |
| 3. Report recommending cessation of improvement. | | | | | 1891 | 2431-2433 |
| 4. Report on New River in vicinity of mouth of Greenbrier River. | House | 176 | Fifty-eighth | Second | 1904 | 2617-2620 |
| 5. Between Radford, Va., and Hinton, W. Va. | ...do... | 1410 | Sixty-second | Third | 1913 | 102 |

* * * * *

3444-R 6. General description of New River.—The New River has its sources in the Blue Ridge Mountains of northwestern North Carolina near the Tennessee line. It flows northeasterly into Virginia until it reaches the Horseshoe near Radford Va., when it turns abruptly to the northwest and keeps that same general trend of flow into West Virginia and to its mouth where it joins the Gauley River to form the Kanawha River. Through almost its entire length the river flows through a rugged mountainous country. Its valley is narrow, the flood plain being very little wider than the low-water channel, which varies in width from about 200 to 1,000 feet. In many places the banks are sheer bluffs rising from the river's edge. Ledges of limestone, sandstone, and shale crossing the river at frequent intervals create rapids and waterfalls. The waterfalls vary in height up to about 18 feet. Between the ledges there are usually short pools of varying depths. The low-water depth in the channel varies from a few inches to more than 6 feet.

3444-S 7. Fall.—From its source at about elevation 3,800 to its mouth at elevation 652, the river has a total fall of 3,148 feet in its length of 341 miles or an average of 9.2 feet per mile. The slope of the river is distributed as follows:

| | Feet per mile |
|---|---|
| From the source of the South Fork to the junction of the forks (86.4 miles) | 15.1 |
| From the source of the North Fork to the junction of the forks (41.5 miles) | 31.5 |
| From the junction of the forks to Washington Mills (48.2 miles) | 6.5 |
| From Washington Mills to the Wythe-Carroll County line (13.8 miles) | 15.2 |
| From the Wythe-Carroll County line to Narrows, Va. (93.0 miles) | 4.8 |
| From Narrows, Va., to Bluestone dam site (35.0 miles) | 4.6 |
| From Bluestone dam site to Hinton, W. Va. (2.4 miles) | 6.2 |
| From Hinton, W. Va., to the mouth of the New River (62.6 miles) | 11.2 |

* * * * *

3444–T 36. Plants officially proposed.—

* * * * *

the Radford and Bluestone projects of the Appalachian Electric Power Co. have received the greatest prominence. The Bluestone project was set up as a single dam about 145 feet high at a site about 3 miles above Hinton. Later the plan was changed to substitute two dams in place of one. The power company applied for and received a permit from the Public Service Commission of the State of West Virginia. After this permit was issued, the power company withdrew its application with the Federal Power Commission and the project was dropped by the latter commission on January 17, 1931. No construction work has ever been done on the project and it is at present inactive. It may be of interest to note that applications for projects 542 and 575 were rejected by the Federal Power Commission for the reason that the applicants proposed to divert water from New River to the Atlantic watershed.

* * * * *

3444–U 39. The site first selected by the power interests for a power dam was just below the mouth of Bluestone River. This was abandoned because of faulty foundation conditions and the choice of sites was transferred to the site considered in this report. The pool level adopted by the power company was at elevation 1515. It was proposed to operate the plant for the production of peak power. This was impracticable, because of the undesirable effect on power plants and navigation below caused by sending the water downstream in waves. Presumably to overcome this objection, the plan was changed to substitute two dams for the one. One of the dam sites would be at Bull Falls, 8.8 miles upstream from the Bluestone site; would be 125 feet high and the plant would be operated as a peak-power development. Another dam, 43 feet high at the Bluestone site, would operate continuously. The lower plant would thus re-regulate the flow of the stream. This would be an ideal arrangement for the production of power but it is not adaptable to the inclusion of flood control.

* * * * *

44. Area and volume of reservoir.—The following table gives the reservoir area and capacity for the various elevations shown:

| Contour, elevation | Area | Volume | Volume | Contour, elevation | Area | Volume | Volume |
|---|---|---|---|---|---|---|---|
| | *Acres* | *Acre-feet* | *Cubic feet* | | *Acres* | *Acre-feet* | *Cubic feet* |
| 1,520 | 9,040 | 625,600 | 27,252,000,000 | 1,485 | 6,375 | 357,400 | 15,556,000,000 |
| 1,515 | 8,636 | 581,400 | 25,337,000,000 | 1,480 | 6,051 | 326,400 | 14,223,000,000 |
| 1,510 | 8,233 | 539,200 | 23,502,000,000 | 1,475 | 5,750 | 296,600 | 12,933,000,000 |
| 1,505 | 7,819 | 499,000 | 21,753,000,000 | 1,450 | 4,574 | 168,400 | 7,336,000,000 |
| 1,500 | 7,446 | 460,800 | 20,092,000,000 | 1,400 | 1,225 | 23,200 | 1,012,000,000 |
| 1,495 | 7,072 | 424,500 | 18,511,000,000 | 1,375 | 216 | 540 | 24,000,000 |
| 1,490 | 6,698 | 390,100 | 17,012,000,000 | 1,370 | 0 | 0 | 0 |

* * * * *

Proposed Dam

53. Description.—The dam will be 1,851 feet long at pool level elevation (1,520) of which 867 feet will be nonoverflow section, 684 feet will be controlled spillway and 300 feet will be powerhouse space. For the passage of floods, 18 crest gates 30 by 30 feet and 6 conduits 10 by 12 feet are provided as shown in the plans (exhibit 12).[1] The crest of the spillway was placed at elevation 1,490 feet, which is as low as was deemed necessary and feasible for operation of the crest gates, in order to reduce the flood gradient in the vicinity of the limiting features near the head of the pool.

* * * * *

3444–V 63. A rule of operation was assumed as follows: Full wheel capacity, approximately 11,000 cubic feet per second to be used at times when water was wasting. At other times 10,000 cubic feet per second to be used to draw the pool down 5 feet, the top 5 feet of the reservoir being reserved for the reception of freshets. Assume the reservoir at 5-foot draw-down about June 1, after which date use natural flows to a minimum of 2,000 second-feet until the pool comes back to a 5-foot draw-down, then repeat the process. From January 1 to about April 15, use full wheel capacity above 5-foot draw-down; use 6,000 cubic feet per second between 5-foot and 10-foot draw-downs, then use natural flows to maximum of 6,000 cubic feet per second. After April 15, restore the pool level to 5-foot draw-down by use of 2,000 cubic feet per second or wheel capacity, then return to operation as of June 1.

* * * * *

3444–W 65. If the plant was operated under a 100-percent utilization factor, approximately half of the power would be generated during the hours of heavy demand for power and half during the low-demand period. For convenience these periods

will be termed day and night, respectively. The unit value of power generated in the two sections of a 24-hour period is about in the ratio of 3 to 1 in favor of the day power. It is therefore advantageous to power development to generate as much power as practicable during the day period. After careful consideration it was decided that the plant can be operated to use during the day twice as much of the daily flow as at night without injurious effect on navigation or power developments downstream. Studies of waves produced by intermittent operation of power plants in the upper reaches of New River indicate that operation with moderate changes in daily flow such as proposed at Bluestone will not require reregulation for navigation and existing power plants downstream. However, further consideration should be given to existing and proposed developments, in the final plan of operation of the Bluestone project, to the end that maximum improvement in flow regulation will be made available for all projects downstream. Consideration should also be given to the fact that at Bluestone a minimum regulated flow of 2,000 cubic feet per second is proposed, whereas the natural flows are often smaller than that amount, the minimum being about 600 cubic feet per second.

* * * * *

3444–X Conclusions and recommendations

74. Conclusions.—(a) From an engineering standpoint the construction of a dam and the creation of a reservoir at the Bluestone site on New River is feasible.

(b) The proposed reservoir, operated for flood control only or for flood control and power combined, will effect savings from flood damages in ratios of costs to benefits that make the project economically justifiable.

(c) Interest of power companies in this section of the river as displayed by more than 30 years of investigation, litigation, and the acquisition of dam sites and flowage rights, indicate a value in the Bluestone project for power development.

(d) The potential power possibilities in an operation combining power production and flood control appears to be of sufficient value to warrant the power interest to bear the cost of some part of the dam in addition to the cost of the power features.

(e) The value of Bluestone power would be increased by the operation of prospective storage reservoirs upstream and by the construction of low-head projects downstream which would reregulate the flow from Bluestone and permit the latter to be operated as a peak-power plant.

75. Recommendations.—The Bluestone Reservoir project, combining flood control and power development, is recommended for construction under the provisions of the National Recovery Act at an estimated total cost of $12,942,000.

JOHN F. CONKLIN,
*Major, Corps of Engineers, District Engineer.*

3445 *Government exhibit No. 146*

Views of shoals and rapids on unimproved section of New River between Wiley Falls, mile 88.6 and Radford, mile 146.1—July 13–15, 1936. (Original Exhibit.)

*Government exhibit No. 147*

Views of shoals and rapids on unimproved sections of New River between Wiley Falls, mile 88.6 and Radford, mile 146.1 and between Allisonia, mile 173.3, and Austinville Lead Mine, mile 190.0—June 22–29, 1936. (Original Exhibit.)

*Government exhibit No. 148*

Photograph of stern of boat showing type of propeller guard in July, 1936. (Original Exhibit.)

*Government exhibits Nos. 149 to 151 incl.*

Photographs of Gerdes' Party at Bull Falls in July 1936. (Original Exhibits.)

*Government exhibits Nos. 152 to 154 incl.*

Photograph of negro at Bull Falls in a rowboat in July 1936. (Original Exhibits.)

*Government exhibit No. 155*

1926—House Doc. #308—69th Congress, 1st Session—Estimate of cost of examinations, etc., of streams where Power Development appears feasible. (Original Exhibit.)

*Government exhibit No. 156*

Record of hearing before State Corporation Commission containing application and copy of State License. (Original Exhibit.)

*Government Exhibit No. 157*

Pilot license of John R. Douglass (read into the record). (Omitted.)

*Government exhibit No. 158*

Map—"Parts of National Forests and Areas approved as National forests within the Kanawha River and New River watersheds." (Original Exhibit.)

*Government exhibit No. 159*

1922, June 12, letter from Geo. Otis Smith, Director U. S. G. S., including the Report #34 enclosed in said letter. (Excluded.)

*Government exhibit No. 160*

Map "Monongahela National Forest—West Virginia"—1936. (Excluded.)

3446 *Government exhibit No. 161*

"Graph of stream flow—storm of March 26, 1936—Bent Creek Experimental Forest." (Original Exhibit.)

Exhibit No. 161 was not offered in evidence, but, with the consent of the defendant, is treated as though it had been admitted over the objection of the defendant, as being immaterial, irrelevant, and incompetent.

*Government exhibits 163 to 182 inc.*

"Photos of dams and reservoirs on upper New River showing silt deposits." (Original Exhibits.)

*Government exhibit No. 183*

Views of pools, shoals, rapids, and dams of Kanawha River and New River between London Lock, West Virginia, and Hawks Nest, West Virginia—July 22, 1936. (Original Exhibit.)

3447 *Government exhibit No. 184*

Photograph entitled "State line in vicinity of Round Bottom Branch." (Original Exhibit.)

3449 *Government exhibit No. 185*

U. S. G. S.—"Peterstown Sheet." (Original Exhibit.)

3451 *Government exhibits Nos. 186 and 187*

Maps and leed descriptions, re Bluestone reservoir. (Original Exhibits.)

3452 *Government exhibit no. 188*

Key property map of A. E. P. Co. for Bluestone reservoir. (Original Exhibit.)

3454 *Government exhibit 189*

(pp. 3–4; 9–39)

Report of Commissioners appointed to view certain rivers within the Commonwealth of Virginia * * * accompanied by a map.

STATE OF VIRGINIA

INLAND NAVIGATION AND IMPROVEMENTS—PREAMBLE AND RESOLUTION

For reprinting the Report of the Commissioners on the Navigation of the Great Kanhawa, &c.

[Agreed to by both Houses of Assembly, February 14, 1814]

Whereas, it would greatly promote the welfare of this Commonwealth, and the prosperity of our sister States, to form a more intimate connexion between the Eastern and Western Waters of the United States; and, with a view to that object, the General Assembly of Virginia, at a former session, appointed Commissioners to survey the head waters of James-River and the Great Kanhawa, with instructions to ascertain the practicability of extending their navigation to the base of
3454-A the chain of mountains which divides them, and at the shortest and easiest portage across it; a trust which was accepted and fulfilled, by the Commissioners who acted therein, in a manner that entitles them to the thanks of their country: And, as the result of their labors has never been presented to the Legislature of the Union, nor to the governments of the several States, who cannot but feel an interest in the accomplishment of an enterprise so important to the arts, manufactures, and commerce of the United States—

Resolved, therefore, That the executive of this commonwealth be, and they are hereby empowered and requested, to cause the Report of the Commissioners to be reprinted, and the Map and References accompanying it to be reduced to a convenient scale, engraved, printed, and annexed to the Report; and, reserving

two hundred and fifty copies thereof for the use of the General Assembly, to forward a copy to each of the Commissioners whose names are subscribed to the Report, to each Member of the Congress of the United States, and to the Executives of the several States and Territories.

3454-B Letter of Mr. Marshall, one of the commissioners.

A communication from the Governor, enclosing a Letter from the Honorable John Marshall, and a report from the Commissioners who executed the act of the last session, entitled "An act appointing Commissioners for the purpose of viewing certain Rivers within this Commonwealth," was laid before the house.

The said Letter and Report were read as follows:

RICHMOND, *December 26, 1812.*

SIR: I hasten to submit to your Excellency, for the purpose of being laid before the General Assembly, the Report of the Commissioners who executed the act of the last session, entitled "An act appointing Commissioners for the purpose of viewing certain Rivers within this Commonwealth."

To their distance from each other, and the consequent difficulties attending the interchange of sentiment, and the attainment of their respective signatures, is to be ascribed the delay which has taken place in the performance of this part of their duty.

The more detailed report, to which the enclosed refers, is not yet received, but it is expected in a few days, and will then be transmitted to your Excellency. It was not thought advisable longer to withhold the general report, for the purpose of accompanying it with that more in detail, to which it refers.

I have the honor to be, Sir, with great respect,

Your obedient servant,

J. MARSHALL.

His Excellency Governor BARBOUR.

3455 INLAND NAVIGATION

REPORT

To the Honorable the Speaker and Members of the General Assembly, the undersigned Commissioners, named, with others, in the act entitled "An act appointing Commissioners for the purpose of viewing certain Rivers within this Commonwealth," respectfully report—

That, supposing the autumn to be the season which afforded the fairest prospects for giving effect to the views of the Legislature,

as expressed in their act, your Commissioners agreed that a me
ing should be called on the first of September, at Lynchburg. T
number required by law, for the execution of the service they w
directed to perform, having assembled, and the necessary prepa
tions having been made, your Commissioners began at the Bric
at Lynchburg, to view James-river, and to take its level by sectio
to the mouth of Dunlop's-creek. Mr. Andrew Alexander, the s
veyor of Rockbridge county, had been engaged to execute this d
under their direction. To this report, which your Commission
believe to be accurate, they beg leave to refer, as exhibiting,
minute detail, the information required by the law.

As an actual measurement of the whole river would have e
ployed so much time as to defer the completion of the work, un
high waters might defeat the object of the Legislature, and w
rendered the less necessary by previous surveys; distances were
general conjectured. The eye, aided by a time piece, and oc
sionally corrected by actual measurement, furnished informati
which, though not perfectly exact, was believed not to vary mu
from the truth, and to be substantially sufficient. Those pla
which present serious obstacles were measured by the chain, a
the elevation was taken throughout by a spirit level.

On that part of the river which is comprised within the chart
already granted, your Commissioners presume that litt
3456 if any, information is expected from them, other than w
be found in the annexed report of Mr. Alexander.

From Beall's Bridge, or Crow's Ferry, to the mouth of the Co
Pasture, no difficulty presents itself, which may not be with c
tainty surmounted. The falls are no where formidable; there a
long stretches of smooth water, and the shallows may be so deepe
as to afford water for boats bringing down from six to eight to
and carrying up from four to six tons, if not throughout the ye
through all but a very inconsiderable portion of it. Your Co
missioners give the opinion, unanimously, and with great con
dence, that the navigation from Crow's Ferry to the mouth of t
Cow-Pasture, may, with improvements by no means expensive,
rendered as certain, as useful, and as permanent, as the navigati
from the same place to Lynchburg; and that it may be used at
times when the navigation to Lynchburg can be used, with bo
carrying an equal burthen—indeed, that it may be rendered mo
safe and less laborious, than that from the mouth of the Nor
Fork to Lynchburg now is.

From the mouth of the Cow-Pasture to the mouth of Dunlop
creek, the difficulties become more considerable, and their remov
will require greater expenditures of money. The mass of wat
diminishes, and the elevation increases. The shoals become long
and shallower, and the intervals of smooth water shorter. Y

this rugged navigation, though totally unimproved, is now used during high water. Boats, laden with the produce of the country, pass every year from the mouth of Dunlop's-creek to Richmond. It is, therefore, proved to be, even at this time, practicable for some portion of the year. This portion varies with the seasons. Most commonly, it commences in November, and terminates late in May, or early in June.

That, by the removal of rocks, now lying promiscuously and irregularly through the bed of the river, which it will be necessary in only a few instances to blow, and by the judicious application of labor, to the collection of water in narrower spaces than it now covers, this navigation may be rendered much more secure
3457 and beneficial, and the time during which it can be used may be considerably extended, will not admit of doubt. Whether this portion of the river may be rendered at all times boatable depends on the depth of water to be collected in particular channels by such means as are applicable to the object.

Some of your Commissioners have been personally engaged in opening the navigation of the North Fork of James river, through Rockbridge. They are decidedly of opinion, that the river denominated "Jackson's," contains as far as Dunlops creek, more water and less formidable obstructions than were found in the North Fork. Yet the North Fork, though its improvement is far from being complete, is now actually used to great advantage, and is not much inferior to the river below. Some experienced and judicious boatmen, who were employed on the expedition, who are well acquainted with the river and its navigation, unite in the declaration, that, if the means be taken which ought to be employed, that part of James river which is between the Cow-Pasture and Dunlop's creek, may be used by any boats which will be capable of continuing their voyage to Lynchburg.

Your Commissioners concur in this opinion; and they take occasion now to remark, that should it be deemed advisable still to adhere to the system of improvement heretofore used in the upper part of the river, the difficulties of this navigation would, they think, be much diminished by several facilities which might be given to it. They would particularly suggest chains, with buoys fastened in rocks or otherwise, or walls on which men may walk, of which boatmen might avail themselves to lessen the labor of ascending places of peculiar difficulty; and thus either to increase the load which may be carried up the river, or to diminish the number of persons necessary for carrying up a given load. They will also mention a fact deemed favorable to the object contemplated by the Legislature. It is this: although the cold may be more intense in the bosom of the mountains than below, this part of the river freezes over.

It will perhaps save the honorable the members of the Legis
lature some calculation, to observe, that the distance from
3458 Lynchburg to the commencement of the Blue Ridge i
stated, in the report of Mr. Alexander, to be twenty-five
miles one-fourth and thirty poles; the elevation to be one hun
dred and eleven feet eight inches; showing an average elevation
of four and an half feet to the mile. The distance through the
mountain, that is from Racoon Island to the mouth of the North
Fork, is eight miles one-fourth and forty-nine poles, and the
elevation one hundred and one feet six inches, giving an average
elevation of upwards of twelve feet to the mile. The distance
from the mouth of the North Fork to Crow's Ferry, or Beall's
Bridge, the highest point to which navigation is to be carried by
the James River Company, is stated at twenty-six miles and
thirty-eight poles, and the elevation is one hundred and thirty-
one feet four inches; making the average elevation five feet to a
mile.

The distance from Beall's Bridge, or Crow's Ferry, to the
mouth of the Cow-Pasture, is stated at thirty-six miles fifty-nine
poles, and the elevation is one hundred and ninety feet three
inches, making the average elevation five and an half feet nearly
to a mile. The distance from the mouth of the Cow-Pasture to
the mouth of Dunlop's creek, is stated at twenty-three miles three
fourths and twenty poles, and the elevation is two hundred and
twenty-eight feet three inches, making the average elevation nine
and an half feet to the mile.

Having reached Dunlop's creek, your Commissioners proceeded
to view and mark out what appeared to them to be the best and
most direct way for a turnpike road from the mouth of that
creek to the most convenient navigable point on Greenbrier river.

With some inconsiderable deviations, which will appear in the
report of Mr. Alexander, already referred to, and some others
which will be suggested, the road now leading from the mouth
of Dunlop's creek, by Bowyer's Sulphur Spring, to Anderson's
Ford, over Greenbrier, at the mouth of Howard's creek, is be-
lieved to be the most eligible which can be made. To that part
of the road which passes from the mouth of Dunlop's creek
to the old Iron Works; a distance of about five miles
3459 there are considerable objections, which your Commission-
ers are inclined to believe may be diminished. The road
crosses the creek eight times, and the ground, during the winter
and spring would, if much used and not well covered with stone
or gravel, be much cut and be very deep. The creek too is fre-
quently so high as not to be fordable.

Should it be found practicable, which your Commissioners be-
lieve to be the fact, to render Dunlop's creek navigable up to its

falls, some distance below the old Iron Works, these inconveniences would be in a great measure removed.

Should it be deemed unadvisable to carry navigation up Dunlop's creek, a direction, as is understood from some of the inhabitants of that neighborhood, may be given to the road, so as to avoid five crossings of the creek, and at the same time shorten the distance. No attempt to view this way was made, because guides could not readily be procured, and your Commissioners feared that, by devoting too much time to a minor object, on which complete information is attainable with ease and certainty through various channels, they might hazard the failure of others which were believed to be of much importance.

The road from the Sulphur Spring to Greenbrier crosses Howard's creek, which is often not fordable, six times, and is in a few places attended with some difficulty. A small improvement may be made in it, and the steepest part avoided, by returning it, near the river, to the ground over which it formerly passed, and from which it has been lately taken.

The road over the mountain has been attentively viewed, and the deviations recommended, from that now in use, carefully and plainly marked. Your Commissioners feel much satisfaction in stating, that the elevation of this part of the road may, in the most unfavorable places, be reduced to an angle of five degrees with the horison. By occasionally removing the earth, for small distances, this angle may be still further diminished. It is believed to be susceptible of improvement on as easy terms as any other road, since the materials for a turnpike are every 3460 where convenient, and not more levelling will be necessary than must be expected in passing through a mountainous country.

Your commissioners proceeded down the Greenbrier river in the boat in which they ascended the James. The season had been remarkably dry, and the water was declared by the inhabitants to be as low as at any period within their recollection. It frequently spreads over a wide bed covered with large stone, and is, in its present unimproved state, and at the season when it was viewed, so very shallow for the greater part of its course, as not to swim an empty boat. The labor of removing stone, and of dragging the boat over those which could not be removed without implements provided for the purpose, was so great, that your Commissioners at one time were enabled to advance only three miles in two days, even with the assistance of a horse and of many additional laborers. In part of the river the shoals are frequent and long, and the falls, as the report of Mr. Alexander will shew, considerable. At the great falls, which

is the most important of them, the descent is twelve feet i
forty-eight poles. There is no perpendicular fall at this plac
but one continued rapid, with large rocks, irregularly inte
spersed through the bed of the river. Near the mouth of th
river there is a flat rock, which continues for about two hundre
and forty poles, with many irregular apertures or fissures throug
which the water passes. Although, in the usual state of th
river, this rock is covered with water of sufficient depth fo
navigation; yet, such was the drought of the last autumn, it w
necessary to drag the boat over its whole extent.

These difficulties present obstacles to navigation during a sea
son when the waters are remarkably low, which can be su
mounted only at a considerable expense.

But, from the best information your Commissioners can ob
tain, and they believe it to be correct, the Greenbrier is seldo
so low at any season as it was during the last autumn; and i
seldom if ever fails, for eight or nine months in the yea
3461 to be at least two feet higher than when viewed by you
Commissioners; a depth of water unquestionably sufficien
for the purpose of navigation. The testimony given by the in
habitants to this fact, was corroborated by appearances on th
river. The indications of a recent considerable diminution o
water were not to be mistaken.

On an attentive consideration of the obstacles which wer
found by your Commissioners to be great; while the river re
mains in the state in which they viewed it, they are unanimousl
and decidedly of opinion, that its navigation may be rendere
as safe, as certain, and as easy as that of the James, at all time
except when the water is unusually low. The rocks are in gen
eral loose, and may be removed without extraordinary difficulty
so as to afford a tolerably smooth passage to boats; and, b
collecting the water into narrow channels, a sufficient depth ma
be obtained, with the exception of a short period in a very dr
year, to swim any boat which can be brought at the same tim
down James river. But so scanty is the supply of water in
time of uncommon drought, that doubts are entertained whethe
there may not be a short season of the year during which, un
less a considerable expense be incurred, the navigation must b
suspended. Though aided by men and horses, ten days of un
remitting labor were consumed in passing from the mouth o
Howard's creek to the mouth of Greenbrier river, a distance no
much exceeding forty-eight miles. In the month of June, th
same voyage, if not retarded by measuring the river, might hav
been performed in a single day. Some of your Commissioner
however, are of opinion, that the Greenbrier may, without gre

additional expense, be rendered at all times passable for boats carrying half a load.

In addition to the shallowness of the water (an inconvenience which is common to all rivers as you approach their sources, and which disappears for eight or nine months in the year), and to the rocks which have been mentioned, the obstructions to the navigation of the Greenbrier consists in its falls, and in the general rapidity of its current.

3462 The great falls alone are of sufficient magnitude to merit particular attention. These unquestionably admit of being rendered navigable, either by opening a sluice judiciously through them, or by locks. The latter would be most expensive, but would leave the navigation less laborious.

The rapidity of the current may be estimated by observing that the descent in forty-eight miles and eighty-four poles, is three hundred and sixty-two feet ten inches, between seven and eight feet to the mile.

This current will present no difficulty to a boat descending the river. To one ascending it, the labor will be considerable, but not so considerable as in some parts of James river.

The night of the 28th of September, was passed among the islands in the mouth of Greenbrier; and on the morning of the 29th, your Commissioners entered New river.

The New river, or that part of the Great Kanawha which is above the mouth of Gauley, having to search its intricate way, and force a passage through a long chain of lofty and rugged mountains, whose feet it washes, exhibits an almost continued succession of shoals and falls, from which the navigator is sometimes, though rarely, relieved by a fine sheet of deep placid water.

The difficulties encountered in descending this river were of a character essentially different from those which were experienced in the Greenbrier. Uncommon as had been the drought, the supply of water was abundant. The boat sometimes, though rarely, rubbed upon a shoal; but in every such case it was apparent that a sufficient passage might be opened without much labor or expense. The velocity of the current and the enormous rocks which often interrupt it, the number and magnitude of the rapids and falls, the steepness, cragginess, and abruptness of the banks, constitute the great impediments which at present exist to navigation between the mouth of the Greenbrier and the Great Falls of Kanhawa.

3463 The distance from the mouth of Greenbrier to Bowyer's Ferry, is forty miles one quarter and forty-six poles, and the descent is four hundred and sixty-six feet seven inches; that is, eleven feet six inches in each mile. In general, there is much sameness in the appearance of this part of the river. Long

rapids, frequently terminated by a fall of from five to ten feet, in a distance of ten, twenty, thirty, and sometimes a greater number of poles; an intervening space, sometimes more, sometimes less considerable, of swift or smooth water; rocks, sometimes above the surface, sometimes near it, so as to require great caution to save a boat from dashing on them; a copious stream, with a current commonly impetuous, constitute its leading characteristics.

Falls too great to come within this general description, will be particularly noticed.

Brook's Falls are about four miles and one-fourth below the mouth of Greenbrier. The water descends thirteen feet seven inches in fifty poles. In its most rapid part the descent is five feet ten inches in fourteen poles. The boat was navigated through this place.

A much more formidable obstruction is the falls at Richmond's Mill. These are designated in the neighborhood by the name of the "Great Falls of New river," but are generally called at a distance, "Lick-Creek Falls."

At this place the water may with propriety be said to fall perpendicularly twenty-three feet. For this distance, the sheet which dashes over the summit is intercepted only by huge fragments of broken rock, which, having been successively disjointed from the brink of the precipice, have fallen into the foaming basin below, where, piled on each other, they form one or two benches that break the cataract. A small distance lower down is another fall of three or four feet.

Here, for the first time, the boat was taken out of the water and let down by skids.

The ground along which a canal may be carried around these falls, pursuing the course of Richmond's mill-race, was measured, and the elevation taken. The descent was found to be twenty-two feet nine inches, in one hundred and eighty-one poles. 3464 This estimate excludes a part of the falls, between five and six feet of which are just above the head of Richmond's mill-race.

The bottom of the river for some distance above these falls, is a hard rock, often appearing above the surface, and much covered with moveable stones, some of which are very large. The bottom of the mill-race appears to be of the same description.

From Bowyer's Ferry to the Falls of the Great Kanawha, was estimated at nineteen miles and fifty-eight poles, in which distance the river falls three hundred and thirty-one feet; that is, seventeen feet to a mile. The honorable the legislature will perceive, that below the ferry the descent, in the same distance, is greater than above. For a part of this space, the scene is awful and discouraging. The vast volume of water which rolls down

New river, and which, far above the ferry, often spreads, without becoming shallow, over a bed three or four hundred yards wide; is seldom more than one hundred or one hundred and fifty yards wide. In some places, for a mile or more in continuation, it is compressed by the mountains on each side, into a channel of from twenty to sixty yards wide; and even these narrow limits are still more narrowed by enormous rocks which lie promiscuously in the bed of the river, through which it is often difficult to find a passage wide enough for the admission of a boat. In some places the bank is formed of rugged and perpendicular cliffs of entire rock, which appear to be twenty, thirty, and forty feet high; in others, enormous, but unconnected, rocks dip into the water.

There are unequivocal indications of the river's having risen, in these narrows, from thirty to forty feet perpendicularly

Immediately above the mouth of Gauley, the river opens and presents a beautiful sheet of deep smooth water, which is succeeded by the rocks over which it dashes, and forms the Great Falls of Kanawha. The height of these falls is twenty feet four inches. With its name, the river looses its wild and savage aspect. It is no longer confined by rugged cliff, by mountains barely separated from each other, nor interrupted by enormous masses of rocks which are scarcely to be avoided.

3465 Within a short distance above the falls, the current is not unmanageably swift, nor the rocks over which it passes uneven. Below, quite to the rocks which have fallen from the brink over which the cataract rushes, is a deep, smooth and beautiful basin. The river is so wide as to rise, in the greatest freshes, only six or seven feet. The falls themselves constitute the impediment, and the only impediment at this place.

Your Commissioners have deemed it proper to state in their full strength, the difficulties which are to be surmounted in opening the intercourse between this part of the state of Virginia and the western country; and to put the legislature, as far as is possible, in possession of the testimony on which their opinion is formed, as well as of their opinion. If, misguided by their conviction of the importance of the object, they are too sanguine in their hopes of its accomplishment, the facts now communicated will enable the General Assembly to correct the mistaken conclusions which have been drawn, and to determine on the course which will best promote the interests of the public.

The practicability of rendering the Greenbrier navigable has already been stated. The system which may be found best adapted for the improvement of James river, will be equally applicable to the Greenbrier, and will be equally successful. The one river and the other will be rendered more or less valuable as more or less labor and skill may be employed on them; but there can be

no mistake in saying that, without incurring an expense which any would pronounce extravagant they are both capable of being brought into extensive use. Not only in descending, but in ascending also, these rivers may be navigated to great advantage.

With respect to New river, a judgment cannot be formed quite so decisively, nor pronounced quite so confidently. The difficulties are great, and deserve to be seriously considered.

The boat which conveyed your Commissioners, passed from the mouth of Greenbrier, to the place where their expedition terminated, without being taken out of the water, except at the
3466 Great Falls of New river, and at the Great Falls of the Kanhawa. It was navigated in the usual way through all the other difficult places which abound in New river, except two—both below Bowyer's Ferry. Through these it was conducted by ropes.

The boat was not laden, nor was it empty. In addition to the number of hands usually employed in navigation, it carried between two and three thousand weight. The greater part of this burthen was taken out in the most difficult places; but in many of considerable magnitude, it remained in the boat. Where the vessel was guided by ropes, the necessity of resorting to this expedient was occasioned solely by the intervention of rocks, which can be removed.

It is also worthy of notice, that this voyage was performed by boatmen, who, having never before seen the river, were reduced to the necessity of selecting their way at the moment, without the aid of previous information.

The only impediments to the descent of the boat, except at the two great falls already mentioned, were rocks lying so near the surface of the water as to strike the bottom while shooting over them. At the usual height of the river, these rocks would be entirely covered, and all danger from them be removed; but others would be placed in a situation to expose a boat to equal hazard. It is therefore necessary, even for the descending navigation, to open a plain and broad sluice through all the rapids and falls, so as to relieve boats navigating the river from all danger of being dashed against the rocks. This may be effected by removing some and blowing others. This sluice may be so conducted as to graduate the falls where they are most sudden, and thereby, in some degree, to diminish the impetuosity of the current.

Brook's Falls, the Great Falls of New river, and the Great Falls of Kanawha, will probably require and admit of a different course.

The first of these, which is the least formidable of the three, will present three alternatives to the election of those who may be engaged in improving the navigation.

First—One or more locks, which may unquestionably be constructed at this place.

Second—A canal, which is already almost formed, on north side of the river. Its completion would require that e opened for a short distance, both where it would receive the er at the head of the falls and where it would empty itself w them.

o the eligibility of this canal, there can be but one objection. re may be impracticable rock, now hidden by the earth, so r the surface as to render this plan unadvisable.

hird—To open a sluice in the river, along its northern bank, graduate the fall as far as may be compatible with that sys- of operation.

he Great Falls of New river must be turned, by using a canal be cut on the southern side, pursing nearly the tract of hmond's mill race. Should locks be employed, it will most bably be found advisable to place them in this canal. Should s be dispensed with, there will be no difficulty in descending ugh this channel; but the toil of ascending, must, at this e, be considerable.

t the Great Falls of Kanhawa, there is, near Morris's mill, ry eligible place for locks. If a canal be preferred, there is y reason to believe that the ground will admit of one, which be so extended, and the fall thereby so graduated, as to rd a safe passage to loaded boats.

hese observations are formed on the state of the river when ved by your Commissioners. It will readily occur, that they not judge with certainty of the changes which may be brought ut by a great rise of water.

would seem most probable, that by such rise the falls would diminished, because the water at their feet would pass off rapidly than at their head. But the apprehension cannot ntirely discarded, that in the narrows, which have been men- ed, the torrent would, in a flood, be too impetuous to be ted. It is probable, that a moderate elevation of the water would rather facilitate the passage of the boats; at least of those descending the river; but that great floods would suspend the navigation.

aving stated their view of this subject, your Commissioners only add their opinion, that the New River may be relied on certainty, for the transportation of articles from east to

n the practicability of using this channel of conveyance for transportation of articles from the western country, towards rivers which empty into the Atlantic, at least so much of it es between Bowyer's Ferry and the Great Falls of Kanawha,

they must speak with less confidence. The great difficulty consists in the velocity of the current. For several miles, between Bowyer's Ferry and the Falls, it is believed that a canal would be impracticable. The river is suceptible of no other improvement than may be made in its channel, or on its banks. The current is often too rapid to be stemmed by a boat impelled by oars; and the water too deep to admit the use of poles. If a channel, sufficient for the safe passage of vessels, be opened, still some other means than oars or poles must be devised for impelling them up the stream.

Your Commissioners submit with diffidence the following proposition:

First—That boats impelled by steam may be employed successfully on New River.

With the capacities of this powerful agent they are too little acquainted to speak with confidence of the use which may be made of it in the waters of Virginia. Elsewhere, it has certainly been applied with great advantage to the purposes of navigation. Neither have they that intimate knowledge of the velocity of the currents, against which vessels have been propelled by it, to compare them with that of New River, and to hazard any decided opinion on the comparison. But they beg leave to say, that the currents of the Hudson, of the Mohawk, and of the Mississippi, are very strong; and that a practice so entirely novel as the use of steam in navigation, will probably receive great improvement, and the power itself be so diversified in its modifications, as to be applied in new and different situations, as their exigencies may require. It is believed, that a sufficient depth of water is
3469 certainly obtainable, but whether sufficient employment may be found, to justify the use of a vessel which must, in any state of things, be constructed at considerable expense, is a question your Commissioners cannot attempt to solve.

Second—Should it be found impracticable to apply steam with advantage to the navigation of the New river, it is respectfully suggested, that between the Great Falls of Kanawha and Bowyer's Ferry, resort may be had to horse labor.

To give this facility to the navigation, it will be necessary to construct a horse-way along the bank of the river at different heights, or at the most common height of the water. The objection that such way cannot be used at all times, will lose much of its force, when it shall be recollected that the navigation up the river will admit of being suspended for considerable intervals, with less injury to those who use it, than that which conveys to the western country articles imported for general consumption. The construction of this way, however, will require the blowing of a great quantity of rock, and will, consequently, be expensive.

Third—Should neither of these expedients be deemed eligible, it is respectfully suggested, that boats may be forced up the current, where it is too rapid for oars and too deep for poles, by the aid of chains fastened in the rocks on the bank.

Whatever doubts may be entertained respecting the navigation for boats ascending the river between the Great Falls of Kanawha and Bowyer's Ferry; your Commissioners are entirely persuaded of the practicability of using it advantageously between the ferry and the mouth of Greenbrier.

In obedience to the law under which they have acted, your Commissioners will now proceed to state their ideas of the sums of money which will probably be necessary to open the river and make the road they have viewed.

No part of their duty has been performed with less confidence than this.

3470 It will readily occur to the legislature, that no estimate of expense of executing so great a work as that which is to afford to the western parts of Virginia the means of conveying the produce of their lands to markets, and probably to connect Virginia commercially with her sister states in the west, can have just pretensions to exactness. Were the system of improvement, and the extent to which that system is to be carried, accurately defined; any calculations which could now be made, even by professional men, of the sum necessary for its execution, might be found to vary widely from that which would be actually expended. Still less precision can be looked for in the calculations of your Commissioners.

But it must be apparent that the expense of improvement will essentially depend on the object for which the improvement shall be made.

If the views of the legislature shall be limited to the conveyance of articles, the growth of the upper country, down James river, the cheapness of that conveyance will certainly depend much on the degree of perfection to which the improvement may be carried; but the river, being the only channel of conveyance, will, if merely practicable, be used to some extent.

If the views of the legislature shall extend to a free commercial intercourse with the western states, or any of them, the channel selected for that intercourse will come into competition with others which now exist or may be opened, and must recommend itself to a preference by the advantages it offers. With a view to the latter object, no improvement ought to be undertaken but with a determination to make it complete and effectual.

The estimates of expense were most particularly made by Mr. Caruthers, who has been personally engaged in opening the North Fork through Rockbridge. This gentleman made his calculations

on the plan which has been adopted by the James River Company, with such improvements as would better adapt that plan to steam navigation. According to his estimate, one hundred and ninety thousand dollers will be sufficient to accomplish the
3471 work from Beall's Bridge's or Crow's Ferry, to the Falls of the Great Kanawha, including the road. This estimate is formed on a comparison of the impediments to be removed, with those he had himself encountered in opening the North Fork of James river. Some others of your Commissioners, who have too little knowledge of the labor necessary for the accomplishment of objects of this description, to confide themselves, in their own judgment, much less to recommend it to the confidence of others, are so impressed with the magnitude of the difficulties they have seen, as to be unable to persuade themselves that the work can be completed for the sum at which it has been estimated. That estimate does not appear to them to be extravagant, if the descending navigation alone be contemplated. To make the ascending navigation such as will entitle it to extensive use, and give this a preference over other routes, they submit, though with much diffidence, the opinion that at least a half a million, perhaps six hundred thousand, will be requisite

From the mouth of Dunlop's creek to the mouth of Howard's creek, is twenty-eight miles and forty-four poles. From the first mentioned place to the summit of Alleghany mountain, is sixteen miles and thirty-six poles, and the elevation is nine hundred and forty-eight feet, which makes an angle with the horison of less than three-quarters of a degree. From the summit of the mountain to the mouth of Howard's creek, the distance is twelve miles and eight poles, and the descent is eight hundred and thirty-eight feet seven inches, making with the horison an angle of about three-quarters of a degree. There are no peculiarities attending this route, which will render any plan the legislature may prefer for turnpiking it, more costly in its application to this road, than to others which have been constructed in various parts of the United States. It is now at least equal to, perhaps better, than any other of equal distance in the same part of the country.

In presenting to the honorable the legislature the advantages which, in the opinion of your Commissioners, will probably accrue to this state from executing the work to which their report
3472 relates, it will be necessary to divide this subject, and to consider, separately—first, those which may reasonably be expected to result from executing it in part; next, those which are to be looked for from executing it in the whole.

Should the navigation of James river be carried up to the mouth of Dunlop's creek, and a turnpike road be made over the Alleghany mountain, although nothing further should be done, a considerable

impulse will be given to the agriculture, and a valuable effect produced on the wealth and population of a considerable tract of country. It cannot reasonably be doubted, that Bath, a part of Botetourt, and a great part of Greenbrier, Monroe, and perhaps even Giles, would find a real interest in searching for a market on James river, for the produce of their soil, if such safe and cheap conveyance were afforded them as might be given by the improvements which have been stated. Agriculture would mingle more than heretofore with grazing; and industry would flourish, when the reward of industry should be attainable. Those more western countries, whose distance might forbid the attempt to transport grain manufactured into flour, or distilled into spirits, to the markets on James river, might still be encouraged to bring to those markets, salt, salted provisions, and various manufactures of hemp. An increase of population would result, not only from the check which this state of things would give to emigration, but also from its operation on the inhabitants, in other respects.

Other parts of the state would derive corresponding advantages from their intercourse with a section of the country which would have more to sell and more to purchase than at present. By the augmentation of the wealth and population of a part, not only would those belonging to that part be improved in their circumstances, but the whole would be more powerful, and the public burdens being more divided, might press less heavily on each individual.

These advantages would probably be extended by improving the navigation of the Greenbrier also.

3473 Should New river be rendered a safe and easy channel of communication, between the Ohio and the commercial towns on James river, the subject will assume a more important aspect, and the advantages may be estimated on a larger scale. Not only will that part of our own state which lies on the Kanawa and on the Ohio, receive their supplies and send much of their produce to market through James river, but an immense tract of fertile country, a great part of the states of Kentucky and Ohio, will most probably give their commerce the same direction. All that part of the state of Kentucky which lies above Louisville, and all that part of the state of Ohio whose trade would pass through the river of that name, might reasonably be expected to maintain a large portion of their commercial intercourse with the Atlantic states, through the James or the Potowmac. Certainly in a contest for this interesting prize, the states through which those rivers run have geographical advantages, the benefit of which they can lose only by supineness in themselves, or by extraordinary exertions in others. It is far from being impossible,

that even the south-western parts of Pennsylvania may look down one of these rivers for their supplies of goods manufactured in Europe.

Let the importance attached by men best acquainted with the subject to the commerce of the west attest its value. The exertions which other states appear to be making to secure it, will probably awaken the attention of Virginia to that part of it which should naturally belong to her.

There is still another aspect in which this subject deserves to be viewed.

That intimate connection which generally attends free commercial intercourse, the strong ties which are formed by mutual interest, and the interchange of good offices, bind together individuals of different counties, and are well calculated to cherish those friendly sentiments, those amicable dispositions, which at present unite Virginia to a considerable portion of the western people. At all times the cultivation of these dispositions
3474 must be desirable but in the vicissitude of human affairs in that mysterious future which is in reserve, and is yet hidden from us, events may occur to render their preservation too valuable to be estimated in dollars and cents.

The advantages which may result to Virginia, from opening this communication with the western country, will be shared in common with her by the states of Kentucky and Ohio.

Considering it as a medium for the introduction of foreign articles into those states, it has claims to their serious attention.

The proposition that a nation finds its true interest in multiplying its channels of importation, admitting them to be equally convenient, is believed to be incontrovertible. In addition to those arguments in support of this proposition which belong to every case, the situation of the western states suggests some which are peculiar to themselves, and which well deserve their consideration.

The whole of that extensive and fertile country, a country increasing in wealth and population with a rapidity which baffles calculation, must make its importations up the Mississippi alone or through the Atlantic states. When we take into view the certain growth of the country, we can scarcely suppose it possible that any commercial city on the banks of that river can keep pace with that growth, and furnish a supply equal to the demand. The unfriendliness of the climate to human life, will render this disparity between the commercial and agricultural capital still more sensible. It will tend still more to retard a population of that sound mercantile character, which would render some great city on that majestic river, a safe emporium for the western world.

In times of profound peace, then, the states on the Ohio would make sacrifices of no inconsiderable magnitude, by restricting their

importations to a single river. But, in time of war, their whole trade might be annihilated. When it is recollected that the Mississippi empties itself into the Gulph of Florida, which is surrounded by foreign territory; that the island of Cuba and the coast of East Florida completely guard the passage from its
3475 mouth to the ocean; that the immense commerce flowing down its stream, holds forth irresistible allurements to cruisers, the opinion seems well founded, that scarcely a vessel making for that place could reach its port of destination.

But the length of the voyage up the Mississippi and Ohio, must be attended with delay so inconvenient to persons engaged in commerce, as to render a shorter route, though not less expensive, more eligible. For importation of many articles, there is much reason to believe that a decided preference would always be given to the transportation through the United States, were that transportation rendered as easy as it is capable of being made.

The export trade during peace, so far as the articles exported were designed for a foreign market, would, more probably, pass exclusively down the Mississippi. But those articles which are consumed in the United States, as manufactures of hemp, would find their way to market through interior and shorter channels.

If the direct route through the Atlantic states would, for many purposes, be more eligible than that through the Gulph of Florida, which must be often connected with a coasting voyage to or from an Atlantic port, then the multiplication of those routes, if in themselves equal, by presenting a greater choice, and by accommodating more territory, must be desirable.

But your Commissioners are sanguine in the opinion, that the communication through the rivers they have viewed, if properly made, will possess advantages over every other, which cannot fail to recommend it to a large portion of the states of Kentucky and Ohio. All that part of the western country which draws its supplies and transports its produce through the river Ohio, and which lies east of Louisville and west of the Pennsylvania line, perhaps a part of the state of Pennsylvania itself, could probably use this route more advantageously than any other; unless, indeed, that through the Potowmac, connected with Monongehela, Cheat, or Yohaghena, should come into competition with it, for the eastern part of the country just mentioned.

3476 That it would, for the importation of articles from Europe, and from the east (with a few exceptions), and for the exportation of those which are consumed in the United States, be preferred to the voyage through the Mississippi, unless the introduction of steam boats should essentially vary the present state of things, may safely be assumed from the fact, that a

land carriage between Pittsburg and Philadelphia or Baltimore, and a carriage up or down the Ohio, are now used for the purposes described, in preference to the route by New Orleans.

The present price for the transportation of goods from Philadelphia or Baltimore to Pittsburg, is understood to be from seven to ten dollars per hundred weight.

The price of transportation from Richmond, up James River, to the mouth of Dunlop's Creek, thence across the Alleghany to Greenbrier, and down to the mouth of the Great Kanhawa, will certainly depend on the goodness of the road and the degree of perfection to which the navigation may be carried. Your Commissioners believe that a sound national economy would dictate such improvements as would reduce the price of freight, although the labor employed in making them might be procured by an augmentation of toll, and some expenditure of public money.

Should the navigation of James River be rendered as safe and as easy as may be reasonably expected, and the Greenbrier and New River be improved, in such manner as the object will justify, your Commissioners believe they hazard nothing in saying, that the expense of transporting one hundred weight from Richmond to the mouth of the Great Kanhawa, will not exceed half the price of transporting the same weight from Baltimore or Philadelphia, to the same place.

The immense works meditated in New York, will certainly, if executed, give to that state great advantages in a competition for the trade of the lakes. But if other convenient and more direct channels be opened, it is not probable that the commerce of the Ohio will take the circuitous route by the lakes.

3477 The expense of transportation from New York through the canal contemplated, can only be conjectured. The character of the rivers which would be used, is not well understood, but they must possess many advantages to give them a preference over the direct way through Virginia to the Ohio.

Your Commissioners, however, take the liberty to repeat, that the success of any attempt to obtain that share of the commerce of the west, to which this state, from her geographical situation and her rivers, would seem to be entitled, must depend entirely on the safety and cheapness of her navigation. A mode of transportation by water in itself insecure, or so laborious as to be little less expensive than carriage by land, will never change the channels in which this trade already flows.

The advantages to accrue to the United States, from opening this new channel of intercourse between the eastern and the western states, are those which necessarily result to the whole body from whatever benefits its members, and those which must result to the United States, particularly from every measure

which tends to cement more closely the union of the eastern with the western states.

In those operations, too, which the exigencies of government may often require, this central channel of communication by water may be of great value. For the want of it, in the course of the last autumn, government was reduced to the necessity of transporting arms in waggons from Richmond to the falls of the great Kanhawa. A similar necessity may often recur.

All which is respectfully submitted to the General Assembly, by

JOHN MARSHALL,
JAMES BRECKENRIDGE,
WILLIAM LEWIS,
JAMES M'DOWELL,
WILLIAM CARUTHERS,
ANDREW ALEXANDER.

3478 *Government exhibit No. 189–A*

Map accompanying Exhibit No. 189. (Original Exhibit.)

*Government exhibit No. 190*

Series of maps entitled "New River Survey, 1872 and 1878. (Original Exhibit.)

*Government exhibit No. 191*

Kanawha Valley Power Company license for project #1175, W. Va., including London and Marmet dams. (Original Exhibit.)

*Government exhibit No. 192*

Views of pools, shoals, and rapids on New River between Hinton, West Virginia and Narrows, Virginia—July 19–20, 1936. (Original Exhibit.)

*Government exhibit No. 193*

Views of pools, shoals, and rapids on New River between Narrows, mile 101.0, and Allisonia, mile 172.0—July 9–13, 1936. (Original Exhibit.)

*Government exhibit No. 194*

Photostat of the chart from automatic gage, at Caperton, W. Va., for period August 8 to August 21, inclusive. (Original Exhibit.)

*Government exhibit No. 195*

Blueprint of the recording gage chart at Kanawha Falls, for period July 30 to August 24, inclusive, 1930. (Original Exhibit.)

3479 *Government exhibit No. 196*

Profile of New River, N. C., W. Va. and Va. (Original Exhibit.)

3481 *Government exhibit No. 197*

Map styled "Railroads." (Original Exhibit.)

3482 *Government exhibit No. 198*

Map entitled "New River, Va. and W. Va., Navigation improvements between Hinton and Wilson Creek, 1877 to 1889." (Original Exhibit.)

3484 *Government exhibit No. 199*

Load Curve of the Appalachian Electric Power Co. for week ending November 3, 1935. (Original Exhibit.)

Exhibit No. 199 was not offered in evidence, but, with the consent of the defendant, is treated as though it had been admitted over the objection of the defendant, as being immaterial, irrelevant, and incompetent, and further, that it is not typical but represents data for the week of maximum demand in the year 1935, as specified by Plaintiff.

3486 *Government exhibits Nos. 200 to 200–B incl.*

3 prints U. S. Eng. Office, Huntington, W. Va., showing navigation features (barge lift, log chute, etc.) for Bluestone reservoir project. (Original Exhibits.)

*Government exhibit No. 201*

Map showing existing ferries below the mouth of Wilson Creek on New and Kanawha River. (Original Exhibit.)

*Government exhibit No. 202*

Map showing ferries in operation prior to 1935. (Original Exhibit.)

*Government exhibit No. 203*

Photograph album of ferries on New River. (Original Exhibit.)

*Government exhibit No. 204*

Illustration showing how Radford project could affect operating results of Bluestone development. (Original Exhibit.)

*Government exhibit No. 205*

Photograph taken to show or to determine the direct measurement thickness of sediment in Byllesby reservoir. (Original Exhibit.)

*Government exhibit No. 206*

(Excluded.)

*Government exhibit No. 207*

Sedimentation map of Washington Mills reservoir showing original and present contours. (Original Exhibit.)

*Government exhibits Nos. 208 & 209*

Topographic maps of sections of Washington Mills reservoir showing conditions—April 17 and April 23, 1936—after breakdown. (Original Exhibits.)

3487 *Government exhibit No. 210*

Cross sections showing profiles on two ranges across the Washington Mills reservoir as of 4/17, and again on 4/23, 1936. (Original Exhibit.)

*Government exhibit No. 211*

Columnar sections of borings through sediment of Washington Mills reservoir. (Original Exhibit.)

*Government exhibit No. 212*

Sedimentation map of Byllesby reservoir. (Original Exhibit.)

*Government exhibit No. 213*

Chart showing longitudinal profiles of Byllesby reservoir. (Original Exhibit.)

*Government exhibit No. 214*

Map of Buck reservoir showing present shore line. (Original Exhibit.)

3488 *Government exhibits Nos. 215 to 217, inclusive*

Cross sections showing original and present profiles of the Buck reservoir. (Original Exhibits.)

*Government exhibits Nos. 218 to 220, inclusive*

Cross sections showing the original and present profiles of Fields Mfg. Co.'s reservoir. (Original Exhibits.)

*Government exhibits Nos. 221 to 221-E, inclusive*

Charts of the Ohio River, Pittsburgh, Pa., to mouth showing topography and soundings. (Original Exhibits.)

*Government exhibit No. 222*

(Excluded.)

*Government exhibit No. 223*

Federal Power Commission, National Power Survey, Principal Generating Plants and Electric transmission lines, United States, 1935. (Original Exhibits.)

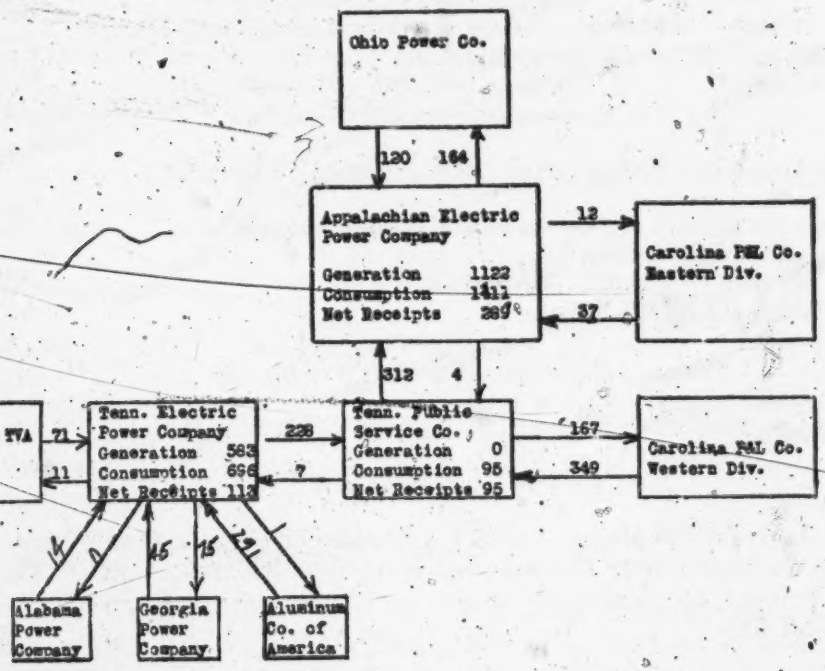
3489 *Government exhibit No. 225*

1 page—"Energy transactions between Appalachian Electric Power Co. and interconnected systems, 1934."

490 *Government exhibit 225*

NERGY TRANSACTIONS BETWEEN APPALACHIAN ELECTRIC POWER COMPANY AND INTERCONNECTED SYSTEMS—1934

Figures are Million Kilowatthours




Data from Public Utility Reports to Federal Power Commission
HGG:KW.
8/12/36.

3491 *Government exhibit No. 226*

Chart—"Study showing operation of Radford with stream flow conditions, as of the week ending Sunday, November 2, 1930, based on load curve, shape proportional to system load reported by Appalachian Electric Co. for week ending November 3, 1935." (Original Exhibit.)

3493 *Government exhibit No. 227*

Map—"Appalachian Electric Power Co., wave study, New and Kanawha Rivers, March 1930." (Original Exhibit.)

*Government exhibit No. 228*

Map—"New River and Kanawha River Power Waves, March 11 to April 3, 1930." (Original Exhibit.)

3495 *Government exhibit No. 229*

Chart—"Automatic Gauge Records, London and Marmet, June 15–19, 1936." (Original Exhibit.)

*Government exhibit No. 229–A*

Corrected Exhibit No. 229. (Original Exhibit.)

*Government exhibit No. 230*

Profile of London, Marmet, and Dam No. 6 pools for June 16, 1936. (Original Exhibit.)

*Government exhibit No. 230–A*

Corrected Exhibit No. 230. (Original Exhibit.)

*Government exhibit No. 231*

Letter dated March 1, 1928, Curtis, Mallet-Prevost, Colt & Mosle to Federal Power Commission, re Project No. 739, A. E. P. Co. (Printed at page 2499 herein as a part of Government Exhibit 91.)

*Government exhibit No. 232*

Executive Order of the President authorizing the construction of the Bluestone reservoir project on New River. (Original Exhibit.)

*Government exhibit No. 233*

Letter from Wm. W. Belknap, Secretary of War, in answer to the resolution of the House, on February 3, 1871, House Document No. 110, concerning James River and Kanawha Canal. (Original Exhibit.)

*Government exhibit No. 234*

"The Congressional Globe"—1873, page 204 and page 206, adoption of resolution offered by Senator Windom. (Original Exhibit.)

*Government exhibit No. 235*

"Journal of the House of Delegates of the State of West Virginia for the 11th Session, 1872–3" re James River and Kanawha Canal. (Original Exhibit.)

3496 *Government exhibit No. 236*

Report of the Committee of the House of Representatives, containing report No. 76 of the 3rd session of the 42nd Congress, re James River & Kanawha Canal. (Original Exhibit.)

*Government exhibit No. 237*

"Congressional Record" Special Session of the Senate of the United States, March 4 to 26, 1873, Volume #1, re James River and Kanawha Canal. (Original Exhibit.)

*Government exhibit No. 238*

Report of Major Craighill with report of Engineers Hutton and Harris, "James River and Kanawha Canal, United States Engineer Office, Baltimore, Md., April 11, 1873. (Original Exhibit.)

3497 *Government exhibit No. 239*

Letter from Senator Davis, of the State of West Virginia, to Sec. of War, W. W. Belknap, dated November 12, 1873, re James River & Kanawha Canal. (Omitted in printing.)

*Government exhibit No. 240*

Report of Board of Engineers of March 18, 1874. (Omitted in printing.)

3565 *Government exhibit No. 241*

Report 307, Part 1, Senate, 43rd Congress, 1st Session, "Select committee on transportation routes to the seaboard, April 24, 1874." (Original Exhibit.)

*Government exhibit No. 242*

Photostatic copy of four pages from "Congressional Record" year 1874, re James River & Kanawha Canal. (Original Exhibit.)

*Government exhibit No. 243*

Statutes at large, Volume 18, Part 3, Page 237, etc. re Act passed June 23, 1874, Chapter 457, for estimates and surveys on transportation routes to the seaboard. (Original Exhibit.)

*Government exhibit No. 244*

Report of Major Craighill, Corps of Engineers, U. S. A., entitled "Third Sub-division of the Central Transportation Route, January 13, 1875. (Original Exhibit.)

3566 *Government exhibit No. 245*

Letter from the Secretary of War, etc., Senate Document No. 15, 44th Congress, 2nd Session, containing the reports of Major Craighill and Brig. Gen. Humphreys, Nov. 10, 1876.

3567 REPORT ON RE-EXAMINATION AND SURVEY OF THE NEW RIVER DIVISION, SURVEY OF 1874, BY MR. N. H. HUTTON, ASSISTANT ENGINEER.

(pp. 54–57)

BALTIMORE, *May 28, 1876.*

COLONEL: I have the honor to submit the following report of the results of the re-examination and survey of the New River division of the central water-line, made under your direction during August, September, and October of 1874.

Your instructions, dated July 15, 1874, said * * * "not later than August 1, you will enter upon a resurvey of the Greenbrier River below Howard's Creek, and of New River below the Greenbrier, the object being to fix the precise location of dams and other details of the slack-water navigation of those streams, with the collection of such additional information as will enable a detailed determination to be made of the location and cost of the canal which, by some engineers, is considered a necessity for that part of the line, and by others a desirable though not a necessary alternative to the slack water. You will keep in view also the possible advantages to be gained by resort to tunnels for avoiding difficult places, in the valley of New River especially, and thereby at the same time shortening the line, either for canal or slack water navigation."

"It is desirable, if possible, that the information you will gain be such as to enable the work along that portion of the line to be put promptly under contract should Congress provide the means." * * *

Under these instructions, the organization of two engineering parties was at once commenced, one for the examination of the slack-water scheme and the other for the survey of an independent lateral canal.

On the 1st of August, both parties were assembled in camp at the mouth of Howard's Creek, and operations were commenced at that point. A rapid reconnaissance meantime was made of the valleys of the Greenbrier and New Rivers, which developed the impracticability of procuring, over this whole distance,
3568 the amount and quality of information called for by your instructions with the time and money at my disposal.

I was accordingly relieved of the duty of examining the Greenbrier division, and the parties under my charge were transferred to the New River, at the mouth of the Greenbrier, where the field-work was resumed on August 8, continuously carried forward to Kanawha Falls, and completed about November 1.

Throughout this division (62 miles in length) transit and level lines were run by both parties, and soundings were made where practicable, to determine the form and character of the river-bottom, depths of water, &c.

Using the survey of 1872 (made under the late Mr. E. Lorraine) as a basis, sites for locks and dams were selected, surveyed, and marked in the field, the governing considerations being that all dams should be located on foundations of solid rock, should, if possible, be at least 600 feet long on the crest, and that they should nowhere endanger, by overflow, the track of the Chesapeake and Ohio Railroad during floods of equal volume to that of 1861.

An experimental line for a lateral canal, with cross-sections of the surface at every hundred feet, was traced and marked from the last dam on the Greenbrier to the pool above Kanawha Falls, a distance of 60 miles. The location was governed by the consideration that the top of the tow-path bank should be two feet above the flood-line of 1861, the marks of which were obtained and noted wherever practicable.

Detailed surveys and measurements were made to determine the cost of removing from the river-bed the masses of loose rock which now encumber it between Keeny's Shoals and Narrow Falls, a distance of about 20 miles, through what is sometimes called the "gorge" of New River.

Surveys were made with a view of cutting off bends in the immediate valley of New River by means of tunnels, wherever practicable, and extended reconnaissances and surveys were made to determine the practicability of suggested lines using tunnels

outside the limits of the immediate valley, and cutting off la
sections of the river proper.

Since the completion of the field-work, the want of money l
greatly retarded the preparation of maps, drawings, and e
mates of cost, which have mainly been done by the of
staff when they could be spared from other duties. Nev
theless, it is believed that the papers, drawings, &c., he
with submitted furnished all the information called for by
instructions.

Plane of reference.

The levels, as marked and described on the maps, drawin
profiles, &c., refer to elevations above tide-water at Richmo
Va.

The basis for all the levels was a bench-mark on the left ba
of the Greenbrier, near our initial point, established by the pa
under the late Mr. Ed Lorraine, in 1872. This bench-mark w
in turn, established by levels based upon a bench-mark est
lished by parties under Mr. W. R. Hutton, in 1870, on the l
bank of the Greenbrier, near the mouth of Howard's Creek,
levels having been brought over the Alleghanies by these parti

During the summer of 1874 other lines of levels were brou
over the Alleghanies by parties under Lieut. Thomas Tur
United States Engineers, which were found to differ somewh
from those of 1870, and upon their prolongation to the mou
of the Greenbrier this difference was increased largely, so th
according to the last levels run, our bench-mark at initial po
was 4.8 feet too low. This discrepancy was not discovered un
the field-work and notes of both divisions were completed, a
in order that the drawings might correctly represent the conte
of the note-books, the original levels have been retained a
marked, so that the water-surface at dam No. 32 of the Gre
brier division appears to be 4.8 feet higher on the maps a
profiles of that division than the level of the same point appe
to be on the maps and profiles of the New River division.
other words, to reduce the levels of New River division to c
respond to those of the Greenbrier division, 4.8 feet must
added to them.

General features of the country.

The New River, throughout the portion which was embrac
within the limits of this survey and report, presents in vari
degrees of development in its different sections the contract
valley and sudden changes of slope usually found in strea
3570 flowing through mountainous districts. Between

Greenbrier and Kanawha Falls, the river may be divided into four sections, possessing, in varying and increasing proportions, from the upper to the lower end, the characteristics referred to.

The first section (about 15 miles long) extends to Meadow Creek, with an average fall (excluding the abrupt fall at Richmond's) of about 7 feet per mile. The valley, though narrow, presents usually on one side or the other strips, at least, of bottomland, and the hill-slopes are not continuously precipitous.

The second section (about 25 miles long) extends to Sewell, with an average fall of about 9 feet per mile. The valley becomes more contracted; bottom-land (properly so called) has almost entirely disappeared, its only representative being short stretches of high benchland. Vertical cliffs impinge more frequently upon the water's edge, and the hill-slopes are everywhere ragged with masses of rock detached from the cliffs, always found at short distances in the rear. At this point (Sewell) is usually said to commence the "gorge" where the river breaks through the high lands connecting the Gauley Mountains with those of Coal River.

The third section (12 miles in length) extends to Hawk's Nest, with an average fall of 17 feet per mile. Throughout this, as well as the following section, the river has cut its way over a thousand feet deep through the highlands, and were it not for the more friable nature of the materials encountered, (sandstones and shales,) would present all the features of a veritable canon as found in metamorphic regions of the Great Basin.

Both valley and river-bed are much contracted, with steep slopes of loose rock thrown down from the cliffs. The water-way is frequently clogged with large masses of rock, through which the river alternately rushes with violence in many narrow streams, or eddies, in deep and sluggish pools.

The fourth section, extending to Narrow Falls, about seven miles in length, has an average fall of 19 feet per mile, and is the culmination of the gradual increase of ruggedness, contrac-
3571 tion, and slope. Though the average fall, as stated, is 19 feet, there are several miles in which the fall is nearly 30; there can hardly be said to be any valley; the vertical and at times overhanging cliffs rise abruptly from the water's edge, or are at best only separated from it by a sloping mass of loose rock of all shapes and sizes; the masses of rock cumbering the water-way appear at times almost to have absorbed the river, which truly offers at first sight small chance for improvement. From this point (Narrow Falls) to the Kanawha Falls the river extends in a wide pool of varying depth, the side-hills come closely down to the river until the Gauley enters on the right bank, from which to

the falls the valley expands on that bank in a wide flat. The width and depths of water-way on this whole division vary so frequently and so greatly, that it would be impossible to give an accurate general statement of them; it may, however, be roughly said in the first section the width is from 400 to 800 feet, with a depth of from 7 to 12 feet in the pools; in the second section, from 250 feet to 400 feet, with the same depths in the pools; and in the third and fourth sections it rarely ever exceeds 250 feet in width, and is often less than 200 feet, with depths in the pools as great at places as 30 to 40 feet.

It flows in alternating pools and rapids, with depths in the latter varying from a few inches in the upper sections of the river to 10 feet in the lower portions. The only vertical falls encountered are Richmond's, about 10 miles below the Greenbrier, where the river falls 28 feet, 15 feet being nearly vertical over a ledge of hard, conglomerate sandstone; and Kanawha Falls, where it descends 19½ feet over a ledge of sandstone. In both cases the river has a width of over 1,000 feet on the high-water crest-line, and immediately above the river is very shallow. At Richmond's Falls, the hill-slopes, or cliffs, come closely down to the water's edge on both sides of the river; at Kanawha Falls, the hills come down closely on the left bank, and a wide, low bottom extends along the right bank.

The Chesapeake and Ohio Railroad occupies the right bank of the river, from the Greenbrier to Hawk's Nest, and the left bank thence to Kanawha Falls. The rock, exposed throughout
3572 is mainly a compact standstone in nearly horizontal beds, occasionally overlaid with red shale, and sometimes merging into a hard conglomerate, as at Richmond's Falls. The hill-slopes are generally formed of debris from the adjacent cliffs in the upper portion, to some extent mixed with alluvial deposits; but lower down they form, as before stated, almost pure masses of detached rock. A large majority of the shoals are composed of loose rock and bowlders, forming dams, over and through which the river flows, and which have apparently (after the manner of the formation of "pot-holes") abraded and broken up the bed-rock to great depths, rendering these apparently-natural sites for dams actually the least desirable, in so far as foundations are concerned. For this reason it will be found that in the present project the dams are frequently located in the deep water, above the shoals, giving an increased height of masonry, but securing undoubted rock-foundations. Except at the shoals, the soundings indicated generally a bottom of rock in place, with little or no deposit overlying it. The bottom-lands have generally a loose, sandy soil, in most cases intimately mixed with debris from the cliffs.

The side-hills are almost entirely destitute of any thing like soil in masses, such as there is being swallowed up in the crevices of the loose rock which everywhere covers their slopes. Nevertheless, walnut and poplar timber, of large size and excellent quality, abounds on these slopes throughout the whole distance.

The sandstone everywhere found is of excellent quality for building purposes, and easily quarried in immediate proximity to the sites where required for use.

The question of water-supply does not enter into the discussion of any method of navigation-improvement, as its abundance is undoubted, its superabundance during freshets being the most formidable obstacle.

Until the construction of the Chesapeake and Ohio Railroad, owing to the scarcity of arable land, the valley between the Greenbrier and Kanawha Falls was an unknown land, except to parties of surveyors or hunters, who at long intervals forced their way down it. Owing to this absence of settlement, we have not only no accurate record as to the volume, frequency, and duration of floods, but not even the ordinary hearsay information
3573 usual in such cases. The wild and gloomy appearance of the river through the "gorge," as seen from the cliffs above, has doubtless caused an exaggeration of their heights and violence, great as they undoubtedly are; but that they attained great heights, with extreme rapidity, is all that we really do know. During the summer of 1861 occurred a freshet which is admitted by the few old settlers scattered throughout the valley to have been the greatest known for forty years; and of this some few records of heights are obtainable, though that they are uncertain may be admitted, when it is known that at one point a difference was found of 7 feet in the elevations, as given by different persons claiming to have seen and noted the flood at its height. However, this flood, and the measures of it thus obtained, have, since its occurrence, been used as the standard of reference by the Chesapeake and Ohio Railroad Company and for all projected improvements of the river, including the projects herewith submitted. To determine its volume, reference has been had to its reported observed height of 8 feet just above the crest of Richmond's Falls.

It has been assumed that for a length of 1,200 feet (which is less than the development of the crest-line by probably 15 per cent.) the discharge was equivalent to that over a weir having 8 feet depth above the comb. This would give a volume for this flood of about 90,000 cubic feet per second, which is the amount that has been assumed heretofore as well as in this project to determine proportions of guard-walls and banks and the heights of dams with reference to the railroad. From observations at

other points of the water-marks of this flood, combined with the cross-sections of the valley, I am inclined to the belief that this estimate of quantity is exaggerated. It is true that the data available are too rude for other than a very approximate solution of the question, and altogether insufficient to justify the construction of works on any other basis previous to the procurement of more reliable information. The matter is referred to simply to call the attention to the possibility of greatly lessening the cost of any scheme of improvement by the aid of more full and reliable data as to the floods. The
3574 reasons for a belief in this possibility are twofold; in the first place, the observed height of 8 feet at Richmond's Falls was toward (if not on) the left bank, from which extends, for more than half the total width of the river, an irregular island, (or peninsula,) immediately below the crest of the falls, at some points really connected with it, at many nearly of equal height, and covered throughout with loose rock and a dense growth of timber, which during this great freshet was in full foliage. It seems almost impossible that this obstruction to the free escape of the water should not have caused an elevation of the level of the crest on this part of the line over that portion which afforded a free discharge, and consequently the assumption that 8 feet was the average depth is an overestimate. Secondly, a comparison of the observed heights of the flood, at some points, with the cross-sections of the valley, with liberal allowances for the unknown and for errors in the known quantities, indicates a volume not exceeding 60,000 or 65,000 cubic feet per second. Should this assumption prove to be true, it will result that the project as now presented will tax the work with difficulties of execution and operation in excess of any probable requirements. The evidence of flood-heights in the "gorge" of 50 to 60 feet was, at the time of this survey, confined to a single log lodged in the cliffs, in the right bank, below Cotton Hill station. This undoubtedly presented evidence of abrasion, as if by contact with water and rocks, yet it may have come down the hill and not up, for almost immediately below it (about 30 feet) is a cave or hole in the cliffs, so situated that it would seem impossible for all, if any, of the drift entering it to escape; yet a careful investigation failed to discover any signs of such deposit within it.

3575 *Government exhibit No. 246*

U. S. G. S. Report No. 20, the Whitetop Area, Virginia-Tenn. (Original Exhibit.)

*Government exhibit No. 247*

Photostatic copy of hearing before Major H. M. Trippe, re Diversion of New River to N. C. Jan. 13, 1925. (Original exhibit.)

*Government exhibit No. 248*

Copy of letter addressed to the Hon. R. J. Noell, East Radford, Va., and signed by R. J. Holden, Professor of Geology, dated March 4, 1936. (Original Exhibit.)

*Government exhibits Nos. 249 to 252 inc.*

"Aerial photos of certain reaches of New River, being nos. 35, 58, 56, 57, in Government Exhibit no. 273." (Original Exhibits.)

*Government exhibit No. 253*

(Excluded.)

*Government exhibit No. 254*

Letter dated November 14, 1927, to Major E. D. Ardery on "New River Development #6, Radford, Geological Examination," signed by F. W. Scheidenhelm. (Original Exhibit.)

*Government exhibit No. 255*

Letter dated November 17, 1927 to Major E. D. Ardery from F. W. Scheidenhelm on "New River Development No. 6 (Radford), Geological Examination." (Original Exhibit.)

*Government exhibit No. 256*

Letter dated October 16, 1931, to Major Fred W. Herman from F. W. Scheidenhelm, pertaining to maintaining pool levels at dams 2, 3, and 4 on Kanawha River. (Original Exhibit.)

3576 *Government exhibit No. 257*

Letter dated September 18th, 1934, to Major John F. Conklin on subject of "Hydro electric project of Appalachian Electric Power Company on New River near Radford, Va."—by F. W. Scheidenhelm. (Original Exhibit.)

*Government exhibit No. 258*

Letter of April 2, 1936, to Major John F. Conklin on "Radford Hydro Project of Appalachian Electric Power Company, Capacity Curve of Reservoir."—by F. W. Scheidenhelm. (Original Exhibit.)

*Government exhibit No. 259*

Letter dated April 12, 1932, to Major Fred W. Herman, on New River Power Wave Study, by F. W. Scheidenhelm. (Original Exhibit.)

*Government exhibit No. 260*

Letter dated April 20, 1932, to United States Engineer Department, signed by Daniel W. Mead and F. W. Scheidenhelm, re "New-Kanawha River Power Wave Study." (Original Exhibit.)

*Government exhibit No. 261*

Telegram dated December 10, 1930, addressed to F. E. Bonner, Executive Secretary, Federal Power Commission, sent by F. W. Scheidenhelm. (Original Exhibit.)

3576–A *Government exhibit No. 263*

WAR DEPARTMENT, UNITED STATES ENGINEER OFFICE
13TH FLOOR, CHESAPEAKE AND OHIO BUILDING
*Huntington, West Virginia, June 26, 1936*

Subject: Kanawha River pool fluctuations resulting from operation of the Marmet and London hydro-plants

KANAWHA VALLEY POWER COMPANY,
*Charleston, West Virginia.*

Attention: Mr. Ellis

GENTLEMEN: At a conference held in this office on June 23, attended by your Mr. Ellis and Mr. McCormack, to consider means for avoiding sudden changes in pool level resulting from operation of the London and Marmet hydro-plants, the attention of your representatives was called to the following:

(a) Changes in pool level in excess of one foot per hour have been of frequent occurrence in both the London and Marmet pools and have reached in excess of 1½ feet per hour.

(b) Dangerous currents are set up by such sudden changes of pool level.

(c) Considerable additional work is caused to the lock operating forces at the movable dams in lowering wickets to pass the excess water and restoring them later to retain sufficient water to maintain the pool.

(d) The Hatfield-Campbell Creek Coal Company has recently complained of the difficulties of moving their fleet to provide for a sudden rise and of grounding during the sudden fall.

(e) The rate of the use of 3-foot drawdown in the London pool s subject to limitation for the purpose of protecting favorable avigation conditions, not only within that pool but in the Mar-et pool and particularly in the pools of the movable dams below Iarmet.

(f) The maintenance of favorable navigation conditions could ot be emphasized too highly as being of primary importance in ne formulation of rules for the operation of the hydro-plants at London and Marmet.

576–B Your representatives advised this office as follows:

(a) The most effective use of the Marmet and London plants is for peak load operation and necessarily involves ome fluctuation of pool levels but it is the aim of their company o minimize such fluctuation as much as may be necessary for avigation interests.

(b) Your plant operators at London and Marmet have been nstructed to cooperate closely with the lockmasters of those ocks to give due notice of plant operation with the view to avoid-ng excessive pool fluctuation but that such excessive waves as ave recently occurred were due in part to imperfection of the resent system of manual control and in part to inadequacy of ne prescribed rules.

(c) A central control system is being established at the Cabin reek steam plant for the more effective coordination of the perations at London and Marmet. This system will be com-leted in about two months and will include a system of auto-natic pool stage indication which will enable the operator at abin Creek to control the operation of each plant in such anner as to attain a minimum amount of pool fluctuation.

Following some discussion, it was agreed to proceed as follows, ith the understanding that the procedure is subject to such odifications as developments may necessitate:

(a) The rate of drawdown in the London Pool will not exceed ne-half foot per hour.

(b) The level of the Marmet Pool will be kept within the nge of +0.0 and −0.3 and pool oscillation on the lower gage London due to turbine operations will not exceed the rate of ne-half foot per hour.

(c) Pending completion of the central control system, current les for manual operation will be modified at once with the ew to minimizing fluctuations as follows:

(1) Power increment, both positive and negative, will be ap-ied at the rate of 5,000 K.W., applied gradually over a period 60 minutes instead of 30 minutes as at present.

3576-C (2) Within the limits of +0.0 to −0.3 at the Marmet upper pool, the operation of the Marmet plant will be started in advance of the London plant and closed in conjunction with the London plant to equalize as much as possible the level of the lower pool at Marmet. Concentration of the heavier peak for shorter duration with incidental fluctuations will be carried primarily at London but in this operation, due care will be exercised at both plants to avoid drawing the lower pool at London below normal.

It is requested that you confirm the above understanding.

Very respectfully,

JOHN F. CONKLIN,
John F. Conklin
*Lt. Col., Corps of Engineers,*
*District Engineer.*

3577 *Government exhibits Nos. 264-A, 264-B and 264-C*

Aerial photographs of New River from Hinton, W. Va. to Narrows, Va. (Original Exhibits.)

*Government exhibit No. 265*

Document on Report on Application for license, Federal Power Project No. 1175, West Virginia, to Chief of Engineers, U. S. Army, Washington, D. C. dated Feb. 24, 1932, at St. Louis, Mo., (changed to defense exhibit No. 525 as it was already in evidence). (Original Exhibit.)

*Government exhibit No. 266*

Dated March 12, 1932 informal comment upon the report of the United States Division Engineer at St. Louis, Feb. 24, 1932, on application of Kanawha Valley Power project No. 1175, West Virginia, by F. W. Scheidenhelm, Consulting Engineer for applicant. (Original Exhibit.)

*Government exhibit No. 267*

(Excluded.)

*Government exhibit No. 268*

(Excluded.)

*Government exhibit No. 270*

(Excluded.)

*Government exhibit No. 271*

Copy of protest to A. E. P. Co. against application of Town of Galax, Va., for grant and loan from government for construction of municipal hydro and diesel engine power plant and distribution system. (Original Exhibit.)

3578 *Government exhibit No. 272*

Letter dated April 9, 1932, from George Otis Smith to Mr. Thompson. (Original Exhibit.)

*Government exhibit No. 273*

Book of aerial photographs of New River, W. Va., Va., and N. C. (Original Exhibit.)

*Government exhibit No. 274*

An Act approved May 6, 1887, incorporating the New River Steam Boat Company, and authorizing them to operate a steam boat on New River. (Original Exhibit.)

*Government exhibit No. 275*

Act of February 3, 1888, of the General Assembly of Virginia, to authorize the Radford Land and Improvement Company to erect a dam across New River. (Original Exhibit.)

3579 *Defendant's exhibits Nos. 500 to 504, inc.*

Discharge hydrographs, wave study of New River. (Original Exhibit.)

*Defendant's exhibit No. 505*

Document dated May 9, 1927, New River Development Company. Record for minutes. (Original Exhibit.)

*Defendant's exhibit No. 506*

Copy of 7th Annual Report of the Federal Power Commission 1927. (Original Exhibit.)

*Defendant's exhibit No. 507*

Gage recorder chart of Kanawha River at Kanawha Falls, W. Va., for the period July 6 to 13, 1936 incl. (Original Exhibit.)

*Defendant's exhibit No. 509*

House Doc. No. 190, 70th Congress, 1st Session. (Original Exhibit.)

*Defendant's exhibit No. 510*

Letter dated Feb. 5, 1927 from Major H. M. Trippe to F. W. Scheidenhelm. (Original Exhibit.)

*Defendant's exhibit No. 511*

Letter dated February 4, 1927 from F. W. Scheidenhelm to Major H. M. Trippe. (Original Exhibit.)

*Defendant's exhibit No. 512*

House Doc. No. 91, 74th Congress, 1st Session. (Original Exhibit.) (Same as Exhibit 145, a part of which is set forth at fol. 3419 herein.)

*Defendant's exhibit No. 513*

Chart-Power Waves on New & Kanawha Rivers. (Original Exhibit.)

3580 *Defendant's exhibit No. 514*

Letter dated October 20, 1931, from F. B. Duis to F. W. Scheidenhelm, re pool levels on Kanawha River. (Original Exhibit.)

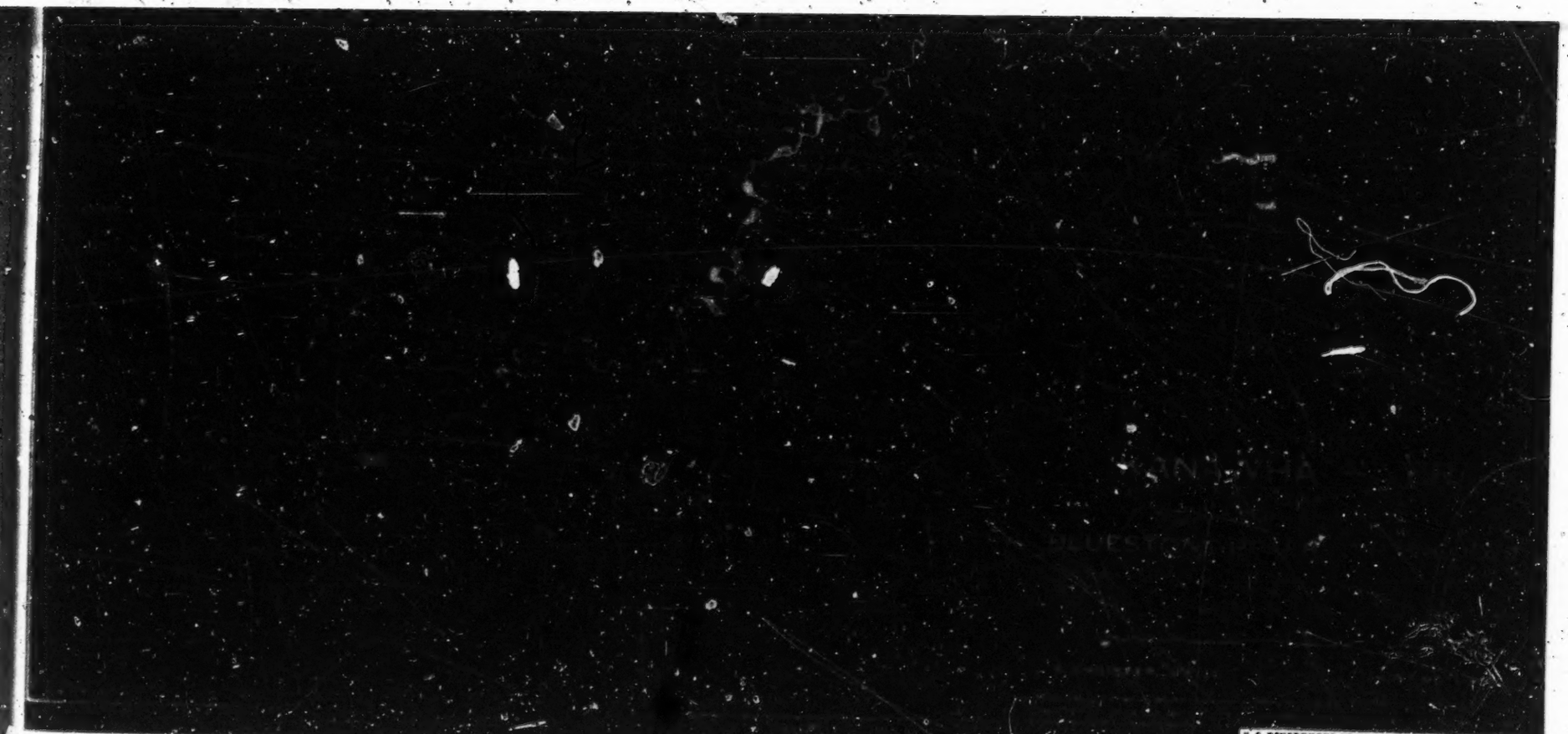
*Defendant's exhibits Nos. 515 to 517 inc.*

Photographs of certain sections of New River. (Original Exhibits.)

3580-A *Defendant's exhibit No. 518*

3580-B *Defendant's exhibit No. 519*

Scarborough's New Census Map of Virginia, W. Va., Maryland, Del. & District of Columbia. (Original Exhibit.)



*Defendant's exhibit No. 520*

Map entitled "The Middle Atlantic Group comprising Va., W. Va., Maryland, Delaware & District of Columbia," published by National Power Survey. (Original Exhibit.)

*Defendant's exhibit No. 521*

Map of Va., Maryland, Delaware & District of Columbia, published by National Map Co., Indianapolis, Indiana. (Original Exhibit.)

*Defendant's exhibit No. 522*

Randall McNally Map of Virginia. (Original Exhibit.)

*Defendant's exhibit No. 523*

Map entitled "Commonwealth of Virginia, State Highway System, State Highway Commission, July 1936." (Original Exhibit.)

*Defendant's exhibit No. 524*

Map of Giles County, Commonwealth of Va., Dept. of Highways, Richmond, Va. (Original Exhibit.)

*Defendant's exhibit No. 525*

Copy of a report on application for license, Federal Power Project No. 1175, W. Va., dated Feb. 24, 1932. (Original Exhibit.)

3581 *Defendant's exhibit No. 526*

Photograph of Shumate Falls. (Original Exhibit.)

*Defendant's exhibit No. 527*

Map dated 11/21/1912, reconnaissance map of New River from Hinton, W. Va. to Radford, Va., compiled under direction of Major F. W. Alstaetter. (Same as original Exhibit 558-G.)

3582 *Defendant's exhibit No. 528*

Report of Major Craighill, Corps of Engineers, U. S. A., dated April 17, 1891.

3583 *Defendant's exhibit 528*

Craighill, Colonel, Corps of Engineers,

U. S. ARMY

U. S. ENGINEER OFFICE, 9 PLEASANT SREET,
*Baltimore, Md., April 17, 1891.*

BRIG. GEN. T. L. CASEY,
*Chief of Engineers, U. S. A., Washington, D. C.*

GENERAL: A balance of $2,341.79 remains of the last appropriation for New River, Virginia and West Virginia, of $10,000, August 1886. For reasons which will appear below it is believed the expenditure of this balance would be a waste of money.

The law of June 10, 1872, called for a survey of the river from the mouth of the Greenbrier at Hinton, West Virginia, to the lead mines in Wythe County, Virginia. A full report, with maps, was submitted in a short time thereafter, which may be found in the Annual Report for 1873, pages 842–54. This included 128 miles of the river.

Three plans of improvement were estimated for, viz: 1st, a 2-feet bateaux navigation to cost $100,000; 2d, a 3-feet steamboat navigation without locks to cost $1,000,000; 2d, a system of locks and dams for a navigation of 5½ feet, to cost $2,500,000.

The first appropriation was made in 1876, $15,000; work was commenced in 1877 and continued several years on the section of the river indicated, with good results for a fine country bordering the stream but up to that time much undeveloped. The railroads of the country at that time were the Norfolk & Western which crossed the river in Pulaski County in the South Western part of Virginia, and the Chesapeake & Ohio which touched it at the mouth of the Greenbrier at Hinton in West Virginia.

The law of June 18, 1878, called for a survey of the upper portion of the river 62 miles in length from the Lead Mines in Wythe County to the mouth of Wilson Creek in Grayson County, Virginia, near the border of North Carolina. The report in full may be found in the Annual Report for 1879, Part 1, pages
3584 538–45. Three estimates were presented for this part of the river also, one half the length of the lower portion already referred to. These estimates were as follows, Viz: 1st, for a 2-feet bateaux navigation to cost $115,000; 2d, for a 3-feet steam navigation $1,200,000; 3d, a 5-feet steam navigation, $1,600,000, with locks and dams.

The plan of improvement adopted for the whole river was that which would cost the least, $215,000, and called for a navigation of 2 feet at low water. There were appropriations in 1880, 1881,

1882. Meantime the usefulness of the river as a means of portation became less and less, due much to the great de- ment of the railroad systems, in some parts paralleling the ; and because the great cost of the improvements especially e upper portions was greatly out of proportion to the ntages under the changed conditions.

re attention may be called to the effect of the changing con- ns which sometimes arise and New River is a striking illus- on of it. In a country rich in minerals and agricultural ucts a natural waterway may be of the greatest value, espe- if there be no competing railroads and the cost of its im- ements be not very great. In course of time competing rail- are built, the topography being favorable. If the expense e improvement of the river be great and the available money the railroads will take the business and the river becomes aratively unimportant. This has for some years been the ion in the New River country, especially the upper portion. time, as population increases and great mining, manufac- g, and agricultural industries become enlarged the im- nce of the natural waterway again increases to such an ex- as to justify a higher style of improvement, and in many nces the construction of canals is also found advantageous. condition has been reached in several of the great European s, and will be in time in the United States.

w River has, however, not reached this stage. It is at pres- n the second stage of comparative unimportance:

is condition seems to have been recognized by Congress as e inferred from the fact that there were no appropriations for New River in 1883, 1884, and 1885. July 1, 1886, there was a balance remaining unexpended of $3,000 from the appropriation of August 2, 1882. This pertained by l designation of the law to the portion of the river above 's Falls, which were not passable. The balance remained ended because of the impassability of these falls. As the nection with routes of transportation caused by these falls practically disappear on the completion of the railroad eing constructed up Cripple Creek, and as boats could hip to the railroad their freight at Porter's Ferry above d mines and the falls, it was concluded to improve the ion of Williamson's ledges and shoals for temporary uses. work was continued as late as the season allowed, a small of funds being left unexpended but not large enough to the resumption of operations in the summer of 1886.

e was an appropriation of $10,000 in the law of August 5, pplicable only to the portion of the river above the lead

mines—the most expensive portion. When the money became available it was too late to commence operations in 1886. For more than one reason it seemed inexpedient to expend this appropriation in the year ending June 30, 1888. The portion of the river to which it was applicable is above Foster's Falls, and these can only be passed by one or two locks, for the construction of which the money available was altogether inadequate. There was also strong reason for doubt whether, considering the present development of that section of the country, the construction of such locks would be justifiable, even if the money were available. The construction of railroads near this stream had diminished very much the importance of the improvement of the portion above Foster's Falls. After a careful re-examination of the subject and reconnaissance of the river and its vicinity, it was decided by the Secretary of War to postpone the expenditure of the appropriation until the will of Congress could be further ascertained.

In the river and harbor act of August 11, 1888, it was, however, directed that the balance should be spent in improving the river between Ivanhoe Furnace, in Wythe County, and the mouth
3586 of Wilson Creek, the most expensive part of the work.

Operations in accordance with this specific direction were therefore commenced June 9, 1889, and continued until October 10, 1889.

In 1885 there was a channel 2 feet deep and 20 feet wide from Ivanhoe Furnace to within 600 feet of the head of Wilkinson's Shoals and Ledges, a distance of 3.9 miles.

In 1889 this channel, with the same width and depth, was extended to the lower end of the approach to the Gulf, a distance of five miles from the initial point, with four-tenths of a mile farther up the river, partially improved. This is obviously a very local improvement made almost entirely in rock at great expense and in my opinion of no value whatever. No work was done in the calendar year 1890, and none has been possible as yet in 1891, the water being too high and too cold.

The last directions of Congress have been practically complied with by the expenditure of 75% of the last appropriation. The last work done, however, under those directions was a subject of ridicule by the community near its locality because of its evident uselessness except to put money into the pockets of a few men and to lead to the probable control of a few votes. The expenditure of the remaining balance almost entirely in the excavation of rock on the limited part of the river to which it is specifically applicable under the law would not accomplish the smallest useful result and would, in my judgment, be a shameful waste of public

money. It is recommended that it be covered into the Treasury as no longer required for expenditure.

No appropriation has been made since 1886.

Very respectfully, your obedient servant,

(Signed) WM. P. CRAIGHILL,
*Colonel, Corps of Engineers, U. S. A.*

3587 BALTIMORE, *April 17, 1891.*

Col. Wm. P. Craighill:

In his opinion the expenditure of the balance of $2,341.79 of appr. of 1886 for New River, Va. & W. Va. would be a waste of money, and recommends that it be covered into the Treasury.

Letter of approval April 23/91; pp. 6 & 7 & Insts.

(1st indorsement)

OFFICE CHIEF OF ENGINEERS, U. S. ARMY,
*April 21, 1891.*

Respectfully submitted to the Secretary of War.

The appropriation of $10,000, made by the River and Harbor Act of Aug. 5, 1886, for improvement of New River, Va., to be applied between the lead mines in Wythe County and the mouth of Wilson's Creek in Grayson County, was, by authority of the Secretary of War of June 4, 1887, reserved, as its expenditure could not at that time be advantageously made.

By the River and Harbor Act of Aug. 11, 1888, the balance then available for the improvement of this river was "directed to be spent in improving said river between Ivanhoe Furnace in Wythe County and mouth of Wilson Creek." Operations in accordance with this specific direction were therefore commenced June 9, 1889, and continued until October 10 of that year, leaving an unexpended balance of $2,341.79.

Colonel Craighill, the officer in charge of the improvement of New River, states that the expenditure of this remaining
3588 balance almost entirely in the excavation of rock on the limited part of the river to which it is specifically applicable under the law would not accomplish the smallest useful result, and would, in his judgment, be a shameful waste of public money.

It is recommended that the unexpended balance be withheld from expenditure until further action is taken by Congress.

W. M. ADAMS,
*Major, Corps of Engineers, In Charge.*

2516–1891.

WAR DEPARTMENT, *April 22, 1891.*

Approved as recommended by the officer in charge of the office of the Chief of Engineers.

S. T. GRANT,
*Acting Secretary of War.*
J. B. R.

Rec'd. Engr. Dept. Apr. 22, 1891.
Noted IV. Division.

3589 *Defendant's exhibit No. 529*

*February 4, 1930.*

Attention: Executive Secretary.
Subject: Project 739 Virginia,
APPALACHIAN ELECTRIC POWER COMPANY,
FEDERAL POWER COMMISSION,
*Washington, D. C.*

SIRS: Regarding the above project, the Company remains firmly of the opinion that its construction, maintenance and operation will not affect the interests of interstate commerce, I. E., injuriously affect navigation on the Kanawha River approximately 150 miles below. At least the method by which it is intended the project shall be operated will have no harmful effect on navigation.

In fact there have always been serious doubts in the minds of many engineers, including Army engineers, as to whether it could be possible to operate the proposed plant in a manner which would substantially interfere with navigation.

The basis for assuming jurisdiction over this project lies in the fact that in very dry seasons there might be such operation as to cause an interference. The Company respectfully submits that such a basis is unfair and beyond the meaning of the Act. The intended methods of construction and of operation are the elements which should be considered and the finding should be based solely on such declared intention and not upon any speculations as to how a project might, but will not, be operated. The Company is willing to submit and agree upon a plan of operation in such further detail as may be appropriate and reasonable under all of the circumstances.

The Company, therefore, respectfully petitions the Commission to reconsider the finding it has made to the effect that the proposed project will affect the interests of interstate commerce and, in arriving at a new conclusion, investigate only the effect that the intended construction together with the intended method of operation will have on navigation below. It is re-

3589-A quested that the Commission find that such intended

construction and intended operation will not (detrimentally) affect navigation.

Upon such a finding the Company would be permitted to construct the project without any license from the United States. Such permission, however, would be limited to the declared or intended methods of construction and of operation. Any harm or threatened harm to navigation, caused by an unanticipated or unintended method of construction or of operation of the project, could certainly be adequately remedied by the United States under the Act of March 3, 1899 (30 Stat. L. 1151). In fact, it is believed that this same remedy would be available to the United States even though the actual or threatened harm proved to be due to the declared or intended method of operation.

In the event, however, the Commission feels that it cannot reopen the question of the effect the proposed project will have on navigation or, in the event the Commission does reconsider this question of fact and finds that it must assume jurisdiction, it is requested that the Commission issue a so-called "minor part" license for the project pursuant to section 10 (i) of the Federal Water Power Act.

In this connection the Company would ask the Commission to reconsider also the letter to the Commission dated March 1, 1928, regarding the validity of the form of license previously tendered to the Company for this project. The legal position therein taken still remains the view of the Company and it believes such a license illegal. The Commission refused at that time to grant a license with only terms and conditions which the Company believes to be within the authority of the United States to impose. At that time, however, both the Company and the Commission had in mind a license for a major project pursuant to Section 4 of the Act with such provisions as some of those demanded by Section 10 of the Act eliminated. This, the Commission believed, it was not authorized to do under the Act.

However, a so-called "minor part" license can legally be issued for such a project, and could contain such provisions only as will protect the interests of the United States in navigation. In substantiation of the authority of the Commission to issue a "minor part" license for such a project there is enclosed herewith a memorandum re "federal Power Commission's Authority to Adopt a Policy of Issuing a 'Minor Part' License For Projects Located on Non-Navigable Streams and Not Involving The Use of Any Land or Other Property of the United States."

Respectfully yours,

APPALACHIAN ELECTRIC POWER COMPANY
By CURTIS, MALLET-PREVOST, COLT & MOSLE

(Enclosure.)

3589–C *Defendant's exhibit No. 530*

**MEMORANDUM RE FEDERAL POWER COMMISSION'S AUTHORITY TO ADOPT A POLICY OF ISSUING A "MINOR PART" LICENSE FOR PROJECTS LOCATED ON NON-NAVIGABLE STREAMS AND NOT INVOLVING THE USE OF ANY LAND OR OTHER PROPERTY OF THE UNITED STATES.**

Dated February 4, 1930

Submitted by Curtis, Mallet-Prevost, Colt & Mosle, in collaboration with Col. F. W. Scheidenhelm, Consulting Engineer.

3589–D

## Synopsis

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(a) The requirement of a license is not justified because the United States has nothing to give or grant, i. e., has nothing to form the basis of a license ..... 2

(b) Congress did not contemplate the issuance of a license pursuant to the second paragraph of Section 23 of the Act when applied to the given circumstances, i. e., a project located on a non-navigable stream ..... 5

II. If the United States is to assume jurisdiction at all in advance of actual or intended acts which will be substantially detrimental to navigation, it may properly do so only in a regulatory capacity ..... 6

i. e., in the strict sense the "license" evidencing such an assumption of regulatory jurisdiction would be one in name only; in essence, it would prescribe an appropriate method of regulation intended to prevent injury to navigation.

III. The prima facie or literal meaning of Sections 10 (i) and 23 of the Act permits the interpretation that a "Minor Part" license is applicable to the given conditions ..... 8

IV. The Congressional records indicate strongly that Congress did not have in mind any contrary interpretation of Section 10 (i) ..... 17

3589–E V. If the Commission were to insist upon taking jurisdiction and issuing a license under the given circumstances, then the terms of a "major" license containing all of the conditions set forth in the Act would be unconstitutional ..... 22

VI. The issuance of a "minor part" license under the given circumstances will be free from attack on the ground of unconstitutionality ..... 23

VII. The issuance of a "minor part" license under the given circumstances would obviate any question as to the continuing right of the United States to safeguard the navigable capacity of navigable streams downstream from the project in point ..... 24

VIII. A "minor part" license, issued under the given circumstances and limited as above indicated, would leave to the respective states the regulation of power developments in all respects except as to the protection of navigation ..... 25

IX. The "minor part" licenses heretofore issued by the Federal Power Commission constitute precedents which are compatible with the proposal of applying such a type of license to the given situation ..... 26

Conclusion.—It is submitted that a "minor part" license would be precisely appropriate and applicable under the circumstances considered herein ..... 32

3589–F (February 4, 1930)

MEMORANDUM RE FEDERAL POWER COMMISSION'S AUTHORITY TO ADOPT A POLICY OF ISSUING A "MINOR PART" LICENSE FOR PROJECTS LOCATED ON NON-NAVIGABLE STREAMS AND NOT INVOLVING THE USE OF ANY LAND OR OTHER PROPERTY OF THE UNITED STATES

I. There is a grave question as to whether the United States may properly require or issue any license whatsoever for a project located on a non-navigable stream and not involving the use of any land or other property of the United States.

The term "license" as used in the Federal water power act is not defined, but Section 4 of the Act states to whom, for what, and under what circumstances licenses can be issued:

"SEC. 4. That the Commission is hereby authorized and empowered * * * to issue licenses to citizens of the United States * * * for the purpose of constructing, operating and maintaining dams, water conduits, reservoirs, power houses, transmission lines or other project works necessary or convenient for the development and improvement of navigation, and for the development, transmission and utilization of power across, along, from or in any of the navigable waters of the United States, or upon any part of the public lands and reservations of the United States (including the territories), or for the purpose of utilizing the surplus water or water power from any Government dam except as herein provided, * * *."

Evidently the foregoing contemplates the issuance of licenses for the purpose of constructing, operating, and maintain-
3589–G ing dams, etc., including any other project works for example, gates controlling the passage of water.

There being no definition in the Act itself, it would seem appropriate to turn elsewhere for definitions of "license."

Bouvier:

"License (Lat. licere—to permit.)

* * * * * *

"In Governmental Regulation. Authority to do some act or carry on some trade or business, in its nature lawful but prohibited by statute, except with the permission of the civil authority or which would otherwise be unlawful."

Corpus Juris:

"License. The term 'license' does not involve any uncertainty or doubt; in its general and popular sense, as used with reference to occupations and privileges, it means a right or permission granted by some competent authority to carry on a business or do an act, which, without such license, would be illegal. It is a for-

mal or official permit or permission to carry on some business or do some act which, without the license, would be unlawful, the words 'license' and 'permit' often being used synonymously,"

Accordingly, it would not be necessary to obtain a license to do an act or carry on some business in its nature lawful and not prohibited by statute.

(a) The requirement of a license is not justified because the United States has nothing to give or grant, i. e., has nothing to form the basis of a license.

3589–H The proper extent of jurisdiction of the United States over projects not involving property of the United States and located on non-navigable streams is clearly described and limited in the opinion of the Court in United States v. Rio Grande Irrigation Co., 174 U. S. 690. This decision stands squarely for the proposition that the United States has no interest in or jurisdiction over any acts carried on in a non-navigable stream unless such acts will substantially diminish navigability and that, if they do have such effect, the United States may restrain those acts only to the extent that they will so diminish navigability.

The Act of March 3, 1899 (30 Stat. L. 1151) forbids any obstruction to the navigable capacity of any waters of the United States. The Rio Grande case supra has in effect validated this legislation, and this essential, namely, the protection of navigation, can be accomplished by the United States through that act. Therefore, so far as the protection of navigability is concerned, a license from the Federal Government is unnecessary inasmuch as there are ample means at the disposal of the Government to effect that end.

3589–I If the use of any lands or other property of the United States were necessary for a given project, then the United States, being able to refuse permission for the use of Government property, might grant such permission conditionally. Such permission would constitute a "license" in the strict meaning of the term, for it would constitute consent to use property the use of which is prohibited by statute except with permission of the owner (the United States). However, the type of project now under consideration does not involve the use of any government land.

It is submitted that a license granted under the second paragraph of Section 23 of the Federal water power act does not grant the licensee even the right to do any acts or carry on any business in its nature lawful but forbidden by statute: Thus, if there were a permission of that kind at all, it would have to be permission to interfere (substantially) with navigation. However, there is considerable basis for the argument that it is be-

yond the power and authority of the United States to permit a substantial interference with navigation.

Moreover, a specific provision of the Act, which negatives any theory that a license issued pursuant to Section 23 may permit (license) any interference with navigation, follows:

"SEC. 10. * * * All licenses issued under this Act shall be on the following conditions:"

* * * * *

"(c) That the licensee * * * shall so maintain
3589-J and operate said works as not to impair navigation. * * *"

Therefore, even as regards navigation which is the sole basis of any interest of the United States, a license under Section 23 grants no right or permission which could have been withheld. In other words, in so far as the license concerns the effect of such a project on navigation, the license does not grant any rights in addition to those which the licensee theretofore had, but rather, on the one hand, permits only what the licensee could theretofore legally do without any permission or license from the United States and, on the other hand, prohibits the licensee from doing any acts which, even without a license, would have been illegal. Thus, in effect, a license under Section 23 appears to be solely restrictive and not in any way permissive.

(b) Congress did not contemplate the issuance of a license pursuant to the second paragraph of Section 23 of the Act when applied to the given circumstances, i. e., a project located on a non-navigable stream.

An examination of Congressional records gives strong reason to believe that the framers of the Act had in mind that the second paragraph of Section 23 would apply only when there is doubt as to the navigability of the stream at the proposed
3589-K site of the power development. At least the records reveal nothing to indicate that the Commission was to take jurisdiction in the case of a project on a non-navigable stream and utilizing no Federal properties.

In substantiation of the foregoing, there is attached hereto and marked Exhibit "A" a memorandum captioned "Intention of Congress Re Second Paragraph of Section 23 of the Federal Water Power Act."

II. If the United States is to assume jurisdiction at all in advance of actual or intended acts which will be substantially detrimental to navigation, it may properly do so only in a regulatory capacity.

I. e., in the strict sense the "license" evidencing such an assumption of regulatory jurisdiction would be one in name only: in

essence, it would prescribe an appropriate method of regulation intended to prevent injury to navigation.

Regarding a project not involving property of the United States and located on a non-navigable stream, it has been submitted that the United States has no interest or jurisdiction unless the actual or intended operation of the project will be of substantial detriment to navigation elsewhere. See U. S. v. Rio Grande Irrigation Co., supra. Furthermore, for such a project, so long as
3589–L the actual or intended operation will not injure navigation, no license is necessary inasmuch as no authority or permission is needed to maintain and operate a project which is in its nature lawful and which could not be forbidden by a law of the United States.

It has also been pointed out hereinabove that, as soon as the actual or intended operation will substantially harm navigation, the United States has jurisdiction to restrain such acts or intended acts * * * but only to the extent that they substantially harm or will substantially harm navigation.

Nevertheless, where a declaration of intention has been filed under Section 23 and the Commission has found that the interests of interstate commerce would be affected thereby, that section makes it obligatory that the declarant shall not proceed with construction until the declarant shall have received a license under the provisions of the Act. Inasmuch, however, as it has been shown that such a license cannot grant permission to do any acts which would be otherwise unlawful, it follows that it is not a license in the strict meaning of the word. Such a so-called license could only prescribe appropriate regulations to prevent injury to navigation and thus in contrast with a true license, it would be merely restrictive and regulatory in its character.

3589–M Furthermore, because such a license does not grant anything which could have been refused or which would otherwise have been unlawful, the licensor cannot demand conditions and terms not necessary for the protection of navigation.

When compared with the scope of a standard license for a major project which is located on a stream which is navigable in fact or which involves the use of property of the United States, such a license embodying merely regulatory terms could only be of minor scope.

III. The prima facie or literal meaning of Sections 10(i) and 23 of the Act permits the interpretion that a "Minor Part" license is applicable to the given conditions.

That part of the Federal water power act which provides for "Minor Part" licenses is as follows:

"SEC. 10. That all licenses issued under this act shall be on the following conditions:"

* * * * *

"(i) In issuing licenses for a minor part only of a complete project, or for a complete project of not more than one hundred horsepower capacity, the commission may in its discretion waive such conditions, provisions and requirements of this act, except the license period of fifty years, as it may deem to be to
3589-N the public interest to waive under the circumstances: Provided, that the provisions hereof shall not apply to lands within Indian reservations."

(1)

According to the express language of that section it is possible for the Commission to grant a license for a minor part of an entire project. It is, therefore, necessary to ascertain in what instances the Commission may properly issue a "minor part" license. As an aid toward a proper analysis, it may be well first to consider situations where "minor part" licenses would seem inappropriate and irrelevant.

Thus, in the case of a project located entirely on public lands of the United States, clearly nothing less than what one may style a "major" license, embodying inter alia all of the conditions set forth in Section 10 of the Act, would be appropriate. As owner, the United States may prescribe conditions at will.

Again, because the United States has paramount control over the navigable waters of the United States, it is within the province of Congress to permit or forbid entirely the erection of structures and their operation in navigable waters. If a project be permitted in a navigable stream, the Government is interested in the entire project, that is, in its construction, its operation and its maintenance. Hence, a "minor part" license would seem inappropriate.

3589-O On the other hand, in the case of a project a small part of which is located on public lands, the interest of the United States obviously is substantially less than in the two former cases. In such an instance it seems reasonable, and would appear to be authorized by the Act, that the Commission issue a "minor part" license therefor. Such a license would contain terms and conditions which could amply protect the Government's interest in the minor part of the complete project. In fact, licenses of this kind have been issued by the Commission. Some of these licenses have permitted the utilization of substantial amounts of Government land.

If a minor part license be appropriate when a part of a project involves United States property, such a type of license seems all the more appropriate when no part at all of the project utilizes United States property and the project is not located on a navigable stream. Such is the type of project herein under consideration.

(2)

Under such circumstances the United States has no interest or jurisdiction over the lands, riparian rights or physical works involved. In fact, its interest is limited to any adverse
3589–P effect which that project might have on the navigable capacity of a navigable stream to which the project stream is tributary. (Rio Grande case, supra.)

Once a dam on a nonnavigable tributary has been completed and its resultant reservoir filled, it is physically impossible that such dam per se, i. e., without interference by man, have any detrimental effect upon navigation downstream therefrom. On the contrary, the effect, if any, would be beneficial (in moderating the intensity of flood peaks). Similarly, an appurtenant power station, if kept free from interference or operation on the part of man, could have no detrimental effect upon navigation. (It is conceivable that failure of a dam or power station would have such detrimental effect, but, if the aspect of safety is to be considered at all, clearly it should be considered from the standpoint of Federal regulation or State police power—certainly not from the standpoint of a Federal grant).

It is to be admitted that the process of initial filling of a reservoir of substantial size could conceivably have a detrimental effect upon navigation in event such filling were to be done during a period of relatively low stream flow. However, ordinarily the filling would not be accomplished during low flow periods—in fact the stream flow might naturally remain high during the period of filling. Moreover, the owner of a dam and res-
3589–Q ervoir would ordinarily not choose a low water period for filling a reservoir, because the rate of filling would be too slow. In any case, this aspect of the matter likewise involves manipulation or operation of the dam or project works and is essentially a question of regulation.

In view of the foregoing, one is led unavoidably to the conclusion that the interest of the United States in a project located on a non-navigable stream and not involving any property of the United States is limited to the operation of the project works and hence to a minor part of the "constructing, operating and maintaining" (Sec. 4 of the Act) of the project, i. e., is limited to a minor part of the project as a whole.

(3)

This conclusion is strengthened when one takes into account the fact that in general it is only a portion of even the operation of the project which holds possibilities of interference with navigation and hence is properly of interest to the United States. For instance, operation of a project during periods of flow above the average would in general contain no possibilities of harm. Indeed, the interest of the United States is limited to such scope or character of operation as would substantially diminish navigability (Rio Grande case, supra).

3589–R Not merely is the interest of the United States limited to a certain portion of the operation of the project, in the sense that the operation directly concerns or constitutes regulation of stream flow, but it is true further that such a conception of operation is incomplete. That is, operation of a water power or hydro-electric project includes substantially more than mere regulation of stream flow. Thus there are elements of operation which concern only the electrical functions of the station and have no effect at all upon stream flow or the regulation thereof.

For instance, the regulation of electrical voltage and electrical frequency are matters of operation of the project but do not concern stream flow. Again, the hydro-electric machines or generating units are, as a practical matter in a large power system, frequently operated without the use of any water at all (excepting a negligible amount for cooling bearings). Under such circumstances the hydro-electric units are used to absorb the wattless current of the power system so as to permit generating apparatus in other power stations, usually steam-electric, to operate in essence more efficiently (specifically, at higher power factor).

It appears clear, therefore, that both in the limited significance of "operation" as affecting only stream flow and also in the broader significance of "operation" as extending to all

3589–S of the elements of use or operation of the hydro-electric development, the interest of the United States is limited to what is only a part of the operation of the project.

(4)

The interest of the United States in the project being minor, it would seem to follow that the Commission would be authorized under Section 10 (i) to issue a "minor part" license.

(5)

That part of the operation of the project in which the United States is interested is limited to the use of the gates, whether the gates be those controlling the passage of water through the power station or those, if any, mounted upon or forming part of the dam outside of the power station. If the United States has control of the gates, it has control of the regulation of stream flow. In other words, it has control of what is practically the only element of the project which may affect navigation downstream from the dam.

Certainly so far as the physical structures are concerned, the gates constitute only a minor part thereof.

Indeed it may be desirable that the proposed "minor
3589–T part" license cover, as the subject of the license, either the operation of the project in so far as the operation involves regulation of stream flow or, alternatively, the construction, operation, and maintenance of the gates themselves. The latter alternative might be deemed preferable in that it would involve the licensing of a minor part of the physical works of the project.

The licensing of the gates appears to be entirely justifiable for the reason that gates constitute "other project works" which in section 4 of the Act are specifically stated to be appropriate subjects of licenses.

The significance and reasonableness of the suggested possibility of licensing the construction, maintenance, and operation of the gates may be the more apparent when considered in the following light:

If on such a non-navigable stream there be constructed an overflow dam not equipped with any gates, not even flash-boards, then (except for the secondary and non-controlling features of safety and of initial filling of the reservoir created by the dam) such dam cannot possibly have any detrimental effect upon navigation downstream therefrom. If in such case there be any detrimental effect on navigation, it must be due to interference on part of man, with resultant modification of the natural stream flow. Such interference or modification can come about only by means of the installation and operation of gates.

3589–U If, then, the United States has control of the installation and operation of those gates, it will have control of the only elements which can result in detriment to navigation. Consequently it would appear logical that the United States, through the Federal Power Commission, should issue a license for the construction, maintenance and operation of all gates affecting stream flow through, over or past the dam. As aforesaid, the gates would constitute a minor part of the project—the more so if appurtenant to the dam there be a power station.

(6)

Although, under Section 23, once the Commission has made a finding that the interests of interstate commerce would be affected (adversely), it is mandatory that the declarant receive a license under the provisions of the Act; the section does not specify in further detail what kind of a license is mandatory. Primarily the Act provides for a "regular" or "major" license (Section 4 (d)) and Section 10 sets forth conditions which must be inserted in such a license. However, Section 10 (i) provides two exceptions to the "regular" or "major" form of license. These are the so-called "minor part" and "minor project" licenses. All of these three forms of licenses are authorized under the provisions of
3589-V. the Act and, therefore, meet the requirements of Section 23. In short, there appearse nothing in the act, itself, which precludes the issuance of a "minor part" license under the circumstances.

It is contemplated that the conditions contained in such a "minor part" license would include only (1) the prescribed limitation to a duration of not more than 50 years and (2) such provisions as are necessary for the protection of navigation.

IV. The Congressional records indicate strongly that Congress did not have in mind any contrary interpretation of Section 10 (i).

(1)

In the preliminary stages of this water power legislation a bill consisting of 29 sections passed the House but the Senate disagreed. A conference committee appointed by the House and Senate to consider the bill made a report February 26, 1919 (House Report No. 1147, 65th Congress, 3rd Session). This report shows that the Conference Committee added to Section 10, paragraph (h), which reads as follows:

"That combinations, agreements, arrangements, understandings, express or implied, to limit the output of electrical energy, to restrain trade or to fix, maintain, or increase prices for electrical energy or service are hereby prohibited"
3589-W the following:

"In issuing licenses for a part only of complete project, where land of the United States required is to be used only for transmission lines, water conduits, or for storage reservoirs, or for a complete project of not more than 50 h. p. capacity, the Commission may in its discretion waive such conditions, provisions and requirements of this Act as it may deem equitable in the circumstances."

The Committee made this statement in regard to the above:

"It is thought by your conferees that such discretion should be vested in the Commission." (February 26, 1919, House Report 1147 to accompany S. 1419, 65th Congress, 3rd Session, Congressional Record Volume 57, page 4635.)

The report of the Conference Committee was agreed to by the House on February 28, 1919, but as the third session of the 65th Congress was drawing to a close the Senate never acted upon the report.

During the first session of the 66th Congress, Congressman Esch introduced a bill, H. R. 3184, which apparently was copied from the previous conference report. Section 10 (h), including the provision for the issuance of licenses for a part only of a complete project, was identical with that above quoted.

The Committee on Commerce of the Senate amended the bill by deleting the above quoted portion of paragraph (h) re the issuance of licenses for a part only of a complete project and added paragraph (i), in the following form:

3589–X "In issuing licenses for a minor part only of a complete project, or for a complete project of not more than 200 h. p. capacity, the Commission may in its discretion waive such conditions, provisions and requirements of this Act, except the licenses of fifty years, as it may deem to be to the public interest to waive under the circumstances."

There is no statement in regard to the purpose of the Committee in making this amendment.

During the course of the reading of the bill in the Senate on January 12, 1920, Senator Curtis proposed "provided that the provisions hereof shall not apply to lands within Indian reservations", which proviso was agreed to, and the bill in this form passed the Senate January 15, 1920.

The bill was then referred to a conference committee of both Houses. The report of the Conference Committee (Senate document 269, 66th Congress, 2nd Session, April 30, 1920) recommended that the bill pass as amended by the Conference Committee. The amended bill included Section 10, paragraph (i) in its present form. The statement accompanying the report contains the following:

"On amendments Nos. 42 and 43, These amendments strike from the House bill the provision authorizing the Commission in its discretion to waive certain conditions, provisions and requirements of the Act in issuing licenses for a part only of a complete project, where land of the United States required is to be used for transmission lines, water conduits or storage reservoirs, or for a complete project of not more than 50 h. p. capacity.

3589-Y In lieu of the House provision the Senate excepted from such waiver the license period of fifty years and increased the capacity of 200 h. p. The House conferees agreed to the Senate substitute with an amendment reducing the horse power capacity to 100. Under the House provision the Commission could allow perpetual grants without conditions for transmission lines, water conduits and storage reservoirs if the remainder of the project was on private land."

The Conference Committee evidently anticipated grants without any conditions but desired them to be limited to 50 years.

The bill, containing Section 10 (i) in its present form, passed both Houses without further debate on paragraph (i).

From the foregoing it appears clear that Congress did not have in mind merely cases where lands of the United States were to be used for transmission lines, water conduits, or a storage reservoir and cases of projects under 100 h. p. capacity. Otherwise, it would seem that the original Section 10 (h) would not have been revised to its present form or, alternatively, in Section 10 (i) there would have been retained the explanatory clause "where land of the United States required is to be used only for transmission lines, water conduits, or for storage reservoirs."

3589-Z Incidentally, it seems fairly clear that "minor part" licenses were intended for cases where an entire storage reservoir is to be located upon lands of the United States; yet in general a storage reservoir is no small part of a project.

(2)

The foregoing discussion (under provision IV) has been in the light of a tacit assumption that Congress intended that under special circumstances set forth in the second paragraph of Section 23, some kind of a license would be required for projects which are located on nonnavigable streams and which do not involve the use of any property in the United States. However, the validity of such an assumption is doubtful, to say the least. In fact, there are good grounds for the contention that Congress did not contemplate that a license should under any conditions be required for such a project. (More detailed consideration of this point will be found at proposition I-(b), page 6, hereinabove and in Exhibit "A" hereof).

If, then, one makes what is apparently the more proper assumption, viz, that Congress did not intend that a license should be required for a project on a non-navigable stream and not involving the use of any property of the United States, it follows that Con-

gress had in mind applying neither Section 4 nor Section 10 (i)
to projects referred to in the second paragraph of
3589-AA Section 23 excepting only when the stream, on which
the pertinent project is located, is upon investigation
by the Commission found to be navigable. In short, under such latter assumption and as regards the type of projects considered herein, it is immaterial what Congress had in mind in drafting Section 10 (i).

V. If the Commission were to insist upon taking jurisdiction and issuing a license under the given circumstances, then the terms of a "major" license containing all of the conditions set forth in the Act would be unconstitutional.

In the case of a project located on a non-navigable stream and involving no property of the United States, a license which contains requirements beyond those necessary for the protection of navigation is subject to at least grave doubt as to its legality. Examples of such illegal provisions are the recapture clause and certain provisions specified by Section 10 of the Act.

This view of the illegality of such a license is set forth in a letter dated March 1, 1928, from Curtis, Mallet-Prevost, Colt & Mosle, on behalf of Appalachian Electric Power Company and may be found on page 143 of the Eighth Annual Report. A copy
of that letter is annexed hereto and marked Exhibit "B."

3589-BB VI. The issuance of a "minor part" license under the given circumstances will be free from attack on the ground of unconstitutionality.

Inasmuch as it is contemplated that such license to be issued under the provisions of Section 10 (i) would contain no conditions excepting those necessary for the protection of navigation, it follows that the license would be free from the objections, on the ground of unconstitutionality, which are cited in Exhibit "B" hereof.

It is a primary rule of construction that, whenever possible, legislation is to be so interpreted that its constitutionality will be preserved. In this connection it is submitted that Section 10 (i) and the second paragraph of Section 23 can jointly and readily, in the light of the foregoing, be so interpreted as to be consistent with each other and with the remainder of the Act and as to be free from successful attack on the ground of unconstitutionality.

Further, it is suggested that, if a court were faced with the alternatives, on the one hand, of insisting that Section 23 demands a "major" license containing all of the conditions recited in Section 10, the recapture clause, etc., with consequent probability of unconstitutionality, and, on the other hand, of confirming
3589-CC an interpretation of Section 10 (i) to the effect that a "minor part" license is applicable under the given cir-

cumstances, then the court would certainly choose the latter alternative because it would preclude the necessity of holding any part of the act unconstitutional.

VII. The issuance of a "minor part" license under the given circumstances would obviate any question as to the continuing right of the United States to safeguard the navigable capacity of navigable streams downstream from the project in point.

The continuing right of the United States (under the Act of March 3, 1899, 30 Stat. L. 1151) to safeguard navigation, downstream from a project such as is under consideration herein, has apparently been challenged only under circumstances under which the Commission pursuant to the second paragraph of Section 23 of the Act makes a finding that the given project will not affect (adversely) the interests of interstate commerce; i. e., when the Commission refrains from taking jurisdiction. The present proposal, however, involves the taking of jurisdiction by the Commission—for this would be the only basis on which it could issue any license at all.

The "minor part" license, it is contemplated, would contain specific provision for the exercise of such a continuing right on the part of the United States.

3589–DD VIII. A "minor part" license, issued under the given circumstances and limited as above indicated, would leave to the respective states the regulation of power developments in all respects except as to the protection of navigation.

If the conditions of "minor part" licenses in point were, as contemplated, limited to those for the protection of navigation, it is obvious that the States would be left in full control in all other respects and particularly there would be no conflict between Federal requirements and State requirements as regards recapture, amortization, etc.

It is understood that the policy of the present administration of the United States is to leave to the respective States jurisdiction as completely as practicable in all matters as to which the fundamental law does not require the Federal Government to exercise jurisdiction.

Moreover, various States have taken pronounced stands on this very question of Federal jurisdiction for water power projects located on non-navigable streams and not involving any property of the United States. These States desire to encourage the development of the streams over which they have jurisdiction and properly resent the intrusion of the Federal Government in

3589–EE a field over which it has no right nor jurisdiction. It is believed that those States could not properly and would not have any objection to the exercise of jurisdiction of a regulatory character for the protection of navigation.

In short, a "minor part" license as contemplated herein would meet the demands of those States.

IX. The "minor part" licenses heretofore issued by the Federal power commission constitute precedents which are compatible with the proposal of applying such a type of license to the given situation.

Standard Forms of Licenses:

In 1921 the Federal Power Commission adopted four standard forms of licenses as follows, viz. for:

(1) A major project on a navigable stream;
(2) A major project on public lands or reservations;
(3) A minor project (100 h. p. or less);
(4) A transmission line.

It is noteworthy that the Commission did not at that time provide a standard form of license applicable to a project located on a non-navigable stream and involving no property of the United States—which circumstances are those constituting the basis of the present discussion. In due course, however, the
3589–FF Commission did issue various "major" licenses for projects located under such latter circumstances.

"Minor Part" Licenses:

Heretofore the Commission has issued minor licenses under two sets of circumstances. The first of these involves transmission lines or water conduits across public lands or reservations.

The second involves situations where only part of the major project is located upon public lands. The reports of the Commission contain various examples, including:

Southern California Edison Co. (Project 298). Third Annual Report, page 95.

Great Western Power Co. (Project 616). Sixth Annual Report, page 254.

However, the Commission also has issued a "minor part" license under circumstances quite different from the foregoing:

"Minor Part" License to Hydraulic Race Co., et al. (Project 15):

This license pertained to a project involving the diversion of water from Niagara River at Tonawanda above eleven miles upstream from Niagara Falls, the transportation of that water through the New York State Barge Canal and finally the utilization of the water for power within the Town of
3589–GG Lockport and in and along "Eighteen Mile Creek."

As to magnitude, the project was greatly in excess of the limit of 100 h. p. which under the terms of Section 10 (i) would have allowed a project to be classed as a minor project.

In fact, the Commission contemplated that the project should develop a minimum of 6,875 h. p.

Again, the project involved the diversion of water from a river which the Commission held to constitute "navigable waters" of the United States. In fact, at the point of diversion the river was and is actually navigated.

The foregoing facts are set forth in the Fifth Annual Report of the Commission at page 109 et seq. At page 111 thereof the minutes of the Commission set forth the reasons for issuing a minor part license, to wit:

"It was further voted that since said power houses and other project works are not located or to be located in or across navigable waters of the United States and do not occupy or involve the use of lands or other property of the United States, and since the carriage of water for use in said works is and will be accomplished through the agency of the State of New York and by means of property of said State, that the commission finds that the diversion of water applied for constitutes a minor part only of a complete project, and that in view of such finding authorization be given to waive, with the exception of the following special conditions, such provisions of the act and of the rules and regulations of the Commission thereunder as are not necessary in the public interest."

3589-HH It is pertinent to compare those reasons with the corresponding conditions obtaining under projects such as are under consideration herein. Thus, in the first place, no project works were to be located in or across navigable waters of the United States. (But in the Hydraulic Race Co. case the contemplated diversion was actually from a navigable river whereas the projects considered herein are located entirely on nonnavigable streams.) Secondly, no project works were to occupy or involve the use of lands or other property of the United States. (The same is true of the type of projects considered herein.) Thirdly, the carriage (transportation) of the water was to be accomplished through agencies other than those of the United States.

These three reasons or conditions find counterparts in the circumstances obtaining in the cases of projects under consideration herein. If there is any difference between the projects considered herein and the Hydraulic Race Co. project, it will appear to lie in the noncontrolling fact that in the latter case the water was transported for some distance between intake and power station. Even that circumstance finds a counterpart in some projects constructed or contemplated on streams which are nonnavigable and where no Federal property is involved.

3589–II In the Hydraulic Race Co. case the Federal license involved ostensibly only the diversion of water. However, the facts were that the diversion was of the essence of the entire project, that such diversion was from a stream which constituted both navigable waters and treaty waters of the United States and that therefore the diversion could not have been made lawfully without the consent of the United States. In short, here was a case where the United States had something to give.

In contrast therewith, in the case of a project located on a nonnavigable stream and not involving the use of any property of the United States, there are the open questions as to whether a license from the United States is necessary and in any case whether the United States has anything to give.

It is submitted that, all facts considered, there would be involved substantially less strain in applying a "minor part" license to the conditions contemplated herein than in applying a "minor part" license to the Hydraulic Race Co. project.

It is of pertinent interest to note that apparently in the Hydraulic Race Co. case the Commission might have licensed the intake works or gates of the project and could have issued a "minor part" license therefor on the ground that such

3589–JJ intake works or gates involved only a minor part of the entire project.

Instead the Commission issued a license for something which is not physical, namely, the diversion of water. Diversion of water is akin in that respect to operation of a dam and power development.

No action by Commission on a Proposal such as that made herein:

It is believed that at no time in the past has the Commission been requested to issue a "minor part" license for a project of major proportions located upon a nonnavigable stream and not involving use of any property of the United States. It is true that, by letter of March 1st, 1928 (Exhibit "B" hereof), Appalachian Electric Power Company requested the Commission to issue for such a project a license free from conditions other than those relating to the protection of navigation. However, both the applicant power company and the Commission had in mind a so-called "major" license, from which the applicant had proposed that there be eliminated certain provisions which it alleged to be illegal. The Commission found that "modification of the form of license as requested in the letter of March 1st would be in violation of the provisions of the Federal Water Power Act." (Eighth Annual Report, page 147.) At no time, however, was the applicability of a "minor part" license considered.

3589-KK Conclusion

It is submitted that a "minor part" license would be precisely appropriate and applicable under the circumstances considered herein.

Submitted by Curtis, Mallet-Prevost, Colt & Mosle, in collaboration with Col. F. W. Scheidenhelm, Consulting Engineer.

3589-LL *Defendant's exhibit No. 531*

FEDERAL POWER COMMISSION.
*Washington, July 21, 1930.*

Secretary of War, Chairman; Secretary of the Interior; Secretary of Agriculture; F. E. Bonner, Executive Secretary.

Address reply to Executive Secretary and refer to MP-739-Virginia, Appalachian Electric Power Company.

DEAR MR. ATTORNEY GENERAL: In your letter of June 13, in reply to my letter of June 9, you suggest that the questions upon which your opinion is desired be formulated. In accordance with that suggestion the following is submitted:

The Federal Power Commission now has before it for consideration an application from the Appalachian Electric Power Company for a license for a power development on the New River in the State of Virginia.

The facts in the case are as follows:

(a) The Kanawha River is entirely in the State of West Virginia and is formed by the junction of the New and Gauley Rivers a short distance above Kanawha Falls. It flows about 97 miles in a general northwesterly direction and empties into the Ohio River at Point Pleasant, West Virginia. It is improved from its mouth for about 90 miles. The existing project was adopted by the River and Harbor Act of June 12, 1875, and provides for eight locks with movable dams and two locks with fixed dams to furnish a 6-foot navigable depth from the mouth to a point 90 miles above.

(b) New River is neither navigated nor navigable in fact.

3589-MM (c) On June 26, 1925, the New River Development Company submitted to the Federal Power Commission a declaration of intention covering the proposed construction of a power development on New River, in Pulaski County, Virginia. The dam was to be located six miles above the city of Radford, Virginia, and about 155 miles above the head of navigation on the Kanawha River.

(d) The United States own no lands or other property in the vicinity of the project.

(e) Under date of September 2, 1926, Appalachian Electric Power Company, as successor in interest to New River Development Company, submitted an application for license.

(f) None of the proposed works is in navigable waters. All are at least 155 miles from the head of navigation. None of the works can in itself offer physical obstruction to navigation. Only by the operation of the works in impounding and releasing water can any effect on the navigable waterway, the Kanawha River, possibly be produced.

(g) At its eighty-eighth meeting, June 1, 1927, the Commission found that said river (New) in the part involved in said declaration is not "navigable waters" within the definition thereof in said act, but that the interests of interstate or foreign commerce would be affected by such proposed construction. The decision of the Commission on this declaration is printed in full on pages 113 and 114, seventh annual report of the Federal Power Commission—1927.

3589–NN (h) On July 1, 1927, the Commission forwarded to the attorneys of the applicant copies of the license which it proposed to issue. Copy of the proposed license is herewith. All the provisions necessary for the protection of navigation on the Kanawha River are contained in Article 14 on page 10 thereof.

(i) Under date of March 1, 1928, Appalachian Electric Power Company addressed to the Federal Power Commission a request that it issue for the project a license containing provisions limited to those which are relevant for the protection of navigation on the Kanawha River. Copy of letter is herewith and also it is printed on pages 143 to 147, inclusive, of the eighth annual report of the Federal Power Commission—1928.

The determination of what is the proper action in this case appears to depend upon the interpretation of Section 23 of the act. It would appear, therefore, that if a license must be issued under Section 23 of the act, consideration should be given as to what provision may be legally included in the license.

It is necessary, in the administration of the affairs of the Commission and to act under the law, to determine the following legal questions:

1. The applicant having agreed to accept the conditions relating to the release of water from the project, may the Commission deny a license and thereby deny to the applicant the use of his property, until he accepts the application to his project on a non-navigable stream of all the provisions of the act?

3589–OO 2. Is the Commission authorized or required, by Section 23 or any other section of the Federal water power act, to write into the license for this project on private

property and on a non-navigable tributary of a navigable waterway, any provisions other than those necessary to insure such release of water therefrom as will maintain unimpaired the navigable capacity of the navigable waterway below, viz., the Kanawha River, or, otherwise stated, may all conditions imposed on licenses on navigable streams, including the recapture clause, be inferred under the facts in this case?

Heretofore the policy of this Commission has been to require the same license conditions both as to licenses for projects on navigable streams and as to those granted for projects on non-navigable streams under Section 23 of the act, but contentions have been made as set out in the attached memorandum which is submitted for your consideration.

Very truly yours,

(Signed) PATRICK J. HURLEY,
*Secretary of War, Acting Chairman.*

Inclosures: Memorandum on Section 23 of the act. Map. Copy of license. 8th annual report—Federal Power Commission. Letter of Curtis, Mallet-Provost, Colt & Mosle of Feb. 4, 1930, and accompanying memorandum. Copy of letter from State Commission on Conservation and Development dated May 29, 1930.

3589–PP *Defendant's exhibit No. 532*

(The following opinion of the Attorney General was released by the Federal Power Commission, September 26, 1930.)

DEPARTMENT OF JUSTICE,
*Washington, September 22, 1930.*

SIR: In response to your letter of July 31, 1930, requesting my opinion on certain questions regarding the issuance of a license under Section 23 of the Federal Water Power Act (41 Stat. 1075; 16 U. S. C., c. 12, Sec. 817) contained in a letter addressed to me by Hon. Patrick J. Hurley, Secretary of War, as Acting Chairman of the Federal Power Commission, under date of July 21, 1930, I have the honor to advise you as follows:

The questions submitted arise in connection with the application of the Appalachian Electric Power Company for a license for a projected water power development on New River, a nonnavigable stream. The power Company has requested the Commission to issue a license containing only such conditions as the Commission shall deem reasonable and appropriate for the protection of navigation on the Kanawha River, a navigable stream to which the New River is tributary, and has declined to accept a license ten-

dered by the Commission containing all of the conditions, provisions, and requirements specified in the Federal Water Power Act of June 10, 1920, 41 Stat. 1063, c. 285. This request and declination of the Appalachian Electric Power Company are contained in its letter of March 1, 1928, directed to the members of the Commission and published in the Eighth Annual Report of the Federal Power Commission, at pages 143 to 147.

3589–QQ The questions submitted are as follows:

1. The applicant having agreed to accept the conditions relating to the release of water from the project, may the Commission deny a license and thereby deny to the applicant the use of his property, until he accepts the application to his project on a non-navigable stream of all the provisions of the Act?

2. Is the Commission authorized or required, by Section 23 or any other section of the Federal Water Power Act, to write into the license for this project on private property and on a non-navigable tributary of a navigable waterway, any provisions other than those necessary to insure such release of water therefrom as will maintain unimpaired the navigable capacity of the navigable waterway below, viz., the Kanawha River, or, otherwise stated, may all conditions imposed on licenses (sic) on navigable streams including the recapture clause, be inferred (sic) under the facts in this case?

The facts of the case as recited in the Commission's letter of July 21, 1930, are as follows:

The Kanawha River is a navigable stream entirely within the State of West Virginia. It is formed by the junction of the New and the Gauley Rivers, a short distance above Kanawha Falls; flows thence about 97 miles in a generally northwesterly direction, and empties into the Ohio River at Point Pleasant, West Virginia. It is navigable for 90 miles above its mouth, a 6-foot navigable depth being maintained by means of eight locks with movable dams and two locks with fixed dams. New River, upon which the proposed development of the Appalachian Electric Power Company is located, is neither navigated nor navigable in fact. On June 26, 1925, the New River Development Company submitted to the Federal Power Commission a declaration of intention covering the project in question, to be located near Rad-

3589–RR ford, in Pulaski County, Virginia, about 155 miles above the head of navigation on the Kanawha River. The United States owns no lands or other property in the vicinity of the project. None of the proposed works is in navigable waters and none can in itself offer physical obstruction to navigation. Only by the operation of the works in impounding and releasing water, and thus creating an uneven stream flow, can any effect upon the navigability of the Kanawha River be produced. Under the date

of September 2, 1926, Appalachian Electric Power Company, as successor in interest to New River Development Company, submitted its application for license under Section 23 of the Federal Water Power Act. The Commission thereafter, on June 1, 1927, made the following decision with respect to this application:

"The Commission having caused investigation of such proposed construction to be made and it appearing from such investigation and from reports submitted thereon that said project, unless operated in the interests of interstate or foreign commerce in accordance with the requirements of said Act, would have an adverse effect on such interests, but if operated in accordance with such requirements would materially benefit such commerce, thereupon found that said River and the part thereof involved in said declaration is not "Navigable waters" within the definition thereof in said act, but that the interests of interstate or foreign commerce would be affected by such proposed construction." (Seventh Annual Report of the Federal Power Commission, 1927, pp. 113–114.)

In my opinion of July 1, 1930, with reference to an application for license for a power project on the Cumberland River in Kentucky, I had occasion to advise you in regard to the application of Section 23 of the Federal Water Power Act to a project for the development of water power on the upper nonnavigable part of a stream which in its lower reaches was a highway of interstate commerce, and concluded that the
3589–SS Commission had jurisdiction in that case to entertain the application of the Cumberland Hydroelectric Power Company for a license to carry on its project on the Cumerland River. Similarly in this case I am constrained to conclude that in view of the findings of the Commission above quoted the Commission has power to entertain the application of the Appalachian Electric Power Company, and to issue a license for this project under the provisions of Section 23 of the Act. The Commission having found that the interests of interstate and foreign commerce would be affected by the proposed construction, the Appalachian Electric Power Company is prohibited by the terms of Section 23 of the Federal Water Power Act from proceeding with the construction of its project "until it shall have applied for and shall have received a license under the provisions of this Act."

Section 10 of the Act provides that all licenses issued under the Act, except minor part licenses authorized under paragraph (i) of Section 10, shall be on certain specified conditions, and such other conditions not inconsistent with the provisions of the Act as the Commission may require. Many of the conditions specified in Section 10 appear to have no effect in preventing

impairment of or in developing the navigable capacity of t
Kanawha River, which can only be effected by the manner
which the flow of the stream is controlled in connection with t
operation of the projected water power. It is to such conditio
that the applicant for a license objects. The only authori
granted to the Commission to dispense with these conditio
specified in Section 10 is found in subdivision (i) of Section 1
which reads as follows:

3589–TT "(i) In issuing licenses for a minor part only of
complete project, or for a complete project of not mo
than one hundred horsepower capacity, the Commission may
its discretion waive such conditions, provisions, and requiremen
of this Act, except the license period of fifty years, as it ma
deem to be to the public interest to waive under the circum
stances: Provided, That the provisions hereof shall not apply
lands within Indian Reservations."

The question is therefore presented whether the Commission ma
in this case issue a minor part license with such conditions as
shall deem necessary in the public interests.

The legislative history of this provision throws but little ligh
upon its precise meaning. The genesis of the clause is found i
a Conference Committee Report on a Bill pending in the 65t
Congress which failed of passage. (House Report No. 1147, 65t
Congress, 3rd Session; Congressional Record, Vol. 57, p. 4635.
This report shows that the Conference Committee added to Sec
tion 10, paragraph (h), which reads as follows:

"(h) That combinations, agreements, arrangements, or under
standings, express or implied, to limit the output of electrica
energy, to restrain trade, or to fix, maintain, or increase prices fo
electrical energy or service are hereby prohibited. In issuing
licenses for a part only of a complete project, where the land o
the United States required is to be used only for transmissio
lines, water conduits, or for storage reservoirs, or for a complet
project of not more than fifty horsepower capacity, the commis
sion may in its discretion waive such conditions, provisions, and
requirements of this act as it may deem equitable in the
circumstances."

The only comment upon this amendment found in the Reports is
a statement by the managers on the part of the House: "It is
thought by your conferees that such discretion should be vested
in the commission."

3589–UU During the First Session of the 66th Congress, H. R.
3184 was introduced containing Section 10 (h), as
above quoted, from the Bill which failed of passage in the previ-
ous Congress. Thereafter the Committee on Commerce of the

Senate proposed an amendment to the Bill by deleting the second sentence of paragraph (h), above quoted, and adding paragraph (i) in the following form:

"(i) In issuing licenses for a minor part only of a complete project, or for a complete project of not more than two hundred horsepower capacity, the commission may in its discretion waive such conditions, provisions, and requirements of this act, except the license period of fifty years, as it may deem to be to the public interest to waive under the circumstances." (66th Congress, 1st Session; Senate Report No. 180, p. 15.)

There was no statement in this Report regarding the purpose of the Committee in proposing this amendment.

The Bill passed the Senate, with a proviso added to this clause reading: "Provided, That the provisions hereof shall not apply to lands within Indian Reservations," and was then referred to a Conference Committee of both Houses. In Conference, Section 10 (i) was amended to read in its present form. A statement by the managers on the part of the House appearing in the 59th Congressional Record, Part 6, p. 6384, with reference to this clause, read as follows:

"On amendments No. 42 and 43: These amendments strike from the House bill the provision authorizing the commission in its discretion to waive certain conditions, provisions, and requirements of the act in issuing licenses for a part only of a complete project, where the land of the United States required is to be used only for transmission lines, water conduits, or for storage reservoirs, or for a complete project of not more than 50-horsepower capacity. In lieu of the House provisions the Senate excepted from such waiver the license period of 50 years and increased the horsepower capacity to 200 horsepower. The House conferees agreed to the Senate substitute with an amendment reducing the horsepower capacity to 100. Under the House provision the commission could allow perpetual grants without conditions for transmission lines, water conduits, and storage reservoirs if the remainder of the project was on private land."

3589–VV

The Bill containing Section 10 (i), as thus agreed upon by the Conferees, passed both Houses without debate on this paragraph.

The intent to broaden the application of the clause and thus to bring within the discretion of the Commission the provisions of any license for a minor part of a complete project is entirely clear but precisely what was meant by the clause "In issuing licenses for a minor part only of a complete project" is left obscure, and this clause requires interpretation in the light of the powers which Congress intended to exercise, and the purposes which it intended to accomplish.

Upon the facts stated by the Commission in this case the United States has no power to prevent the construction of the proposed project on the New River unless its operation will tend to impair the navigability of the Kanawha River by changing the normal and regular flow of the stream; and the only interest which the United States has to protect, and for which it may be justified in issuing a license, is a very minor part of the complete project, viz., the manner in which the flow of the stream below the dam is affected by the operation of the water power. I am advised by a representative of the Commission that under a license providing merely for proper control of the retention and release of water, this project will tend to improve the navigability of the Kanawha River. Under these circumstances every

3589–WW purpose within the power of Congress may be accomplished by the issuance of a minor part license under paragraph (i) of Section 10. Accordingly I am of the opinion that the most reasonable construction of this statute is that paragraph (i) of Section 10 was intended to have application in such a case provided the interests of the United States may be fully protected by the issuance of a license to control the flow of the stream and/or to use physical instrumentalities which may be constructed for this purpose, the conditions of such license to be fixed by the Commission in its discretion under Section 10 (i) of the Act.

This interpretation appears necessary in order to avoid serious questions regarding the constitutionality of the Act which might be presented if Section 10 (i) should be interpreted so as to have no application to projects constructed in or on non-navigable streams, which only remotely and indirectly affect the navigability of waters in the lower reaches of streams to which they are tributaries. If paragraph (i) of Section 10 is not applicable in such cases the Commission would in no such case be authorized to waive any of the conditions specified in Section 10, because Section 23 prohibits any such construction, once the Commission finds that the interests of interstate or foreign commerce will be affected, until a license is issued under the provisions of the Act. To hold that the Commission has full authority under this section to exercise its discretion in granting a minor-part license in this case leads to a reasonable construction of the statute and a full accomplishment of its legislative purpose.

3589–XX This interpretation of paragraph (i) of Section 10 finds some support in the administrative construction of the Act adopted by the Commission on May 23, 1925, in its consideration of several applications (Project No. 15) of Hydraulic Race Company and other corporations, reported in the

ifth Annual Report of the Federal Power Commission, 1925, pp. 111 and 112.

In answering the questions proposed by the Commission, I have cordingly to advise you that it is my opinion that the Commis-on may, in its discretion, issue a minor-part license under para-raph (i) of Section 10, for the construction and operation of e project here in question; that it is not required to insert in a ense issued for this project, any conditions (except the fifty-ar limitation upon the terms of the license) which, in its judg-ent, are not necessary or appropriate to fully utilize the waters the New River in the protection or development of navigation the Kanawha River.

Respectfully,

(Signed) WILLIAM D. MITCHELL,
*Attorney General.*

The PRESIDENT.

89-YY *Defendant's exhibit No. 533.*

CURTIS, MALLET-PREVOST, COLT & MOSLE,
ATTORNEYS AND COUNSELLORS AT LAW,
*New York, October 6, 1930.*

Subject: Project 739 Virginia Appalachian Electric Power Company

EDERAL POWER COMMISSION,
*Washington, D. C.*

SIRS: We have been advised of the opinion rendered by the ttorney General of the United States in the above matter dated eptember 22, 1930, and released by your Commission under tte of September 26, 1930.

We respectfully refer to application for license made by the ndersigned Company under date of August 30, 1926 heretofore ed with your Commission under the project number above entioned and we request that such application for license be ly considered and acted upon by your Commission in the light the above mentioned opinion of the Attorney General of the nited States.

In this connection we intend shortly to submit to you appro-iate copies of revised plans to be substituted for certain of e plans which were filed with you as part of the above-men-ned original application.

As evidence of compliance with requirements of the laws of e State of Virginia in relation to the proposed project and pplementing the information submitted with the Company's

original application was send you herewith photostatic copies of letter from the Company to the State Corporation Commission, Richmond, Va., dated June 11, 1930, and the State Corporation Commission's reply dated June 16, 1930.

Respectfully yours,

APPALACHIAN ELECTRIC POWER COMPANY,
By CURTIS, MALLET-PREVOST, COLE & MOSLE.

Enc.
CEM:20

3589-ZZ *Defendant's exhibit No. 534*

Photostat copy of letter of October 16, 1930, to Federal Power Commission, signed—A. E. P. Co., by Curtis, Mallet-Prevost, Cole & Mosle. (Original Exhibit.)

3589-AAA *Defendant's exhibit No. 535*

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
*Washington, November 7, 1930.*

The EXECUTIVE SECRETARY,
*Federal Power Commission,*
*Interior Department Building, Washington, D. C.*

DEAR SIR: 1. Reference is made to your letter dated October 17, 1930, requesting approval by the Chief of Engineers and the Secretary of War of tracings accompanying the application of the Appalachian Electric Power Company (Project 739) for a minor part license to develop water power on the New River, near Radford, Va.

2. In reply I would inform you that the plans, which have been examined and found satisfactory so far as the interests of navigation are concerned, have been approved by the Chief of Engineers and the Secretary of War and are returned herewith.

3. It is understood that the construction of the project will be under the supervision of this office, that all work will be done to the satisfaction of the District Engineer in charge and that detailed plans will be submitted to him for approval as he may direct.

4. It is requested that the condition suggested in your letter of October 3, 1930, and approved in the letter of October 10, 1930, be revised to read as follows:

"Whenever the flow at Lock No. 2, Kanawha River, falls below 1,400 second-feet, the Licensee shall when so directed by the Secretary of War discharge in each 24 hours the natural flow of the river at the dam site during that period up to a discharge of 1,150 acre-feet. The discharge from the project shall at all times be regulated by such rules and regulations as the Secretary of War

may prescribe to prevent undue interference with navigation on the Kanawha River."

For the Chief of Engineers:

Very respectfully,

JOHN J. KINGMAN,
John J. Kingman,
*Lieut. Col., Corps of Engineers.*

Inclosures: subs. 1–6 (tracings).

3589–BBB *Defendant's Exhibit No. 536*

Letter dated October 31, 1930, from F. E. Bonner to A. E. P. Co., re Project No. 739. (Original Exhibit.)

3589–CCC *Defendant's Exhibit No. 537*

FEDERAL POWER COMMISSION

Secretary of War, Secretary of the Interior, Secretary of Agriculture.

Address Reply to F. E. Bonner, Executive Secretary, And Refer To EP–739–Virginia, Appalachian Electric Power Company.

*Washington, November 6, 1930.*

APPALACHIAN ELECTRIC POWER COMPANY,
*c/o Col. F. W. Scheidenhelm,*
*50 Church Street, New York, N. Y.*

GENTLEMEN: Please refer to our letter of October 31.

Further study of the draft of proposed license for the Radford development has resulted in several changes therein, and a revised copy is being transmitted herewith. Please substitute it for the one previously furnished you.

Very truly yours,

(Sd.) F. E. BONNER,
*Executive Secretary.*

Incl. 1088.

Answered Nov. 8, 1930. F. W. Scheidenhelm.

3589–DDD Federal Power Commission

Minor-Part License on Nonnavigable Waters

Project No. 739—Virginia. Appalachian Electric Power Company

Whereas, the act of Congress approved June 10, 1929 (41 Stat. 1063), designated therein as "the Federal Water Power Act" and hereinafter called "the Act," provides, inter alia, "that a commis-

sion is hereby created and established to be known as the Fede
Power Commission," hereinafter called "the Commission," a
"that any person, association, corporation, State, or municipali
intending to construct a dam or other project works across, alo
over, or in any stream or part thereof, other than those defin
herein as navigable waters, and over which Congress has jurisd
tion under its authority to regulate commerce between forei
nations and among the several States; may in their discretion f
declaration of such intention with the Commission, whereupon t
Commission shall cause immediate investigation of such propos
construction to be made, and if upon investigation it shall find th
the interests of interstate or foreign commerce would be affect
by such proposed construction, such person, association, corpo
tion, State, or municipality shall not proceed with such constru
tion until it shall have applied for and shall have received a licen
under the provisions of this Act. If the Commission shall not
find, and if no public lands or reservations are affected, permissi
is hereby granted to construct such dam or other project works
such stream upon compliance with State laws;" and

Whereas, Appalachian Electric Power Company, hereinaft
called "the Licensee," a corporation organized a
3589–EEE existing under the laws of the State of Virginia a
having its office and principal place of business in t
city of Richmond, in the State of Virginia, has made application
due and proper form to the Commission for a license for a pow
project designated as project No. 739 on the records of the Co
mission, and for authority to construct, maintain, and operate
the New River, in the vicinity of Radford, in the County
Pulaski, State of Virginia, certain project works hereinaft
described; and

Whereas, in accordance with the foregoing provision of la
the New River Development Company, a corporation organiz
under the laws of the State of Virginia, did on June 26, 19
declare its intention to construct a dam and other works in t
New River, in the vicinity of said power development; and

Whereas, said Commission caused investigation of the propos
construction to be made as required by said Act, and at
meeting of June 1, 1927, made the following findings:

"In the matter of the declaration of intention, under the pro
sions of Section 23 of the Federal Water Power Act, of Ne
River Development Company, a corporation organized under t
laws of the State of Virginia, to construct a dam and oth
structures across and in New River in the vicinity of Radfo
Pulaski County, State of Virginia, said dam and other structu
being part of a power project proposed to be constructed for t
purpose, inter alia, of the development and utilization of pow

said declaration having been submitted to the Commission under date of June 26, 1925: The Commission having caused investigation of such proposed construction to be made and it appearing from such investigation and from reports
3589-FFF submitted thereon that said project, unless operated in the interests of interstate or foreign commerce in accordance with the requirements of said Act, would have an adverse effect on such interests, but if operated in accordance with such requirements would materially benefit such commerce, thereupon found that said river in the part thereof involved in said declaracion is not 'navigable waters' within the definition thereof in said Act, but that the interests of interstate or foreign commerce would be affected by such proposed construction;" and

Whereas, on September 4, 1926, the Appalachian Electric Power Company presented evidence of its succession to the rights of New River Development Company; and

Whereas, the Commission at its meeting of found that the manner in which the flow of the stream below the dam will be affected by the operation of the project and the conditions which are necessary or appropriate to be imposed upon the project to fully utilize the water of the New River in the protection or the development of navigation of the Kanawha River constitute a minor part of a complete project; and

Whereas, the maps, plans, and specifications of said project and of said project works, as hereinafter described, have been approved by the Commission, and the plans of the dam and other structures affecting navigation have been approved by the Chief of Engineers and the Secretary of War; and

Whereas, the Licensee has submitted to the Commission satisfactory evidence of compliance with the laws of the State of Virginia, as required by Section 9, subsection (b), of the Act; and

3589-GGG Whereas, the Licensee on the day of pursuant to an authorization of its board of directors, a certified copy of the record thereof being hereto attached, accepted in writing all of the terms and conditions of this license:

Now, therefore, the Commission hereby issues this license to the Licensee for a period terminating fifty (50) years from the date hereof, subject to the conditions hereinafter specified, for the purpose of constructing, operating, and maintaining in New River, Virginia, the following project works: A dam, a power plant, and other appurtenant structures and equipment; the location, nature, and character of which works are more fully shown and described by certain exhibits filed with the Commission in connection with

said application for license and which are designated and described as follows:

Exhibit J—Map (FPC No. 739–1) with title "Location Map and Drainage Area (A. E. P.–R. D.–3001)."

Exhibit K—Map (FPC No. 739–9) with title, "General Map of Project (A. E. P.–R. D.–3002)."

Exhibit L—Maps and plans in two sheets (FPC Nos. 739–10, 13) with titles as follows: L–1, "Plan of Dam Site (A. E. P.–R. D.–3003)." L–4, "Elevation and Sections of Dam and Power Station (A. E. P.–R. D.–3005)."

which said exhibits approved by the Executive Secretary on behalf of the Commission are hereby made a part of this license, and no substantial change shall hereafter be made therein, until such change shall have been similarly approved; said license being subject to the following express conditions, other provi-

3589–HHH sions and requirements of the Act being waived under authority of Section 10 (i) thereof.

ARTICLE 1. The Licensee shall begin the construction of said project works on or before January 1, 1932, shall thereafter in good faith and with due diligence prosecute such construction, and shall complete the same on or before December 31, 1936, such construction to be in substantial conformity with the approved exhibits or as modified under proper authorization; and in case the Licensee shall not commence actual construction of the project works within the time prescribed in this license or as extended by the Commission, then, after due notice given, the license may be terminated upon written order of the Commission.

ARTICLE 2. The work of construction under this license shall be subject to the inspection and approval of the District Engineer, U. S. Engineer Office, Huntington, West Virginia, or of such other officer or agent as the Commission may designate, who shall be the authorized representative of the Commission for such purposes. The Licensee shall notify such representative of the date upon which work will begin, and as far in advance thereof as said representative may reasonably specify, and shall notify him promptly in writing of any suspension of construction for a period of more than one week, and of its resumption and completion.

ARTICLE 3. The Licensee shall be liable for all damages occasioned to the property of others by the construction, maintenance, or operation of said project works, or of the works appurtenant or accessory thereto, and in no event shall the United States be liable therefor.

3589–III ARTICLE 4. The License shall allow officers and employees of the United States free and unrestricted access in, through, and across the lands occupied by the project works in the performance of their official duties.

ARTICLE 5. The Licensee shall maintain said project works in a condition of repair adequate for the safe and efficient operation thereof in the development of power and shall make all necessary renewals and replacements for such purpose.

ARTICLE 6. Whenever the flow at Lock No. 2, Kanawha River, falls below 1,400 second feet, the Licensee shall when so directed by the Secretary of War discharge in each 24 hours the natural flow of the river at the dam site during that period up to a discharge of 1,150 acre feet. The discharge from the project shall at all times be regulated by such rules and regulations as the Secretary of War may prescribe to prevent undue interference with navigation on the Kanawha River.

ARTICLE 7. The Licensee shall install and maintain at its own expense such gage or gages and such gaging station or stations, or such other means of stream-flow measurements as the District Engineer of the War Department, in charge of the improvement of the Kanawha River, may deem necessary to protect the interests of navigation.

ARTICLE 8. Whenever the Licensee is directly benefited by the construction of a storage reservoir or other headwater improvement by another licensee, a permittee, or the United States, the Licensee shall reimburse the owner of such reservoir or other improvement for such part of the annual charges for interest, maintenance, and depreciation thereon as the Commission may deem equitable. The proportion of such charges to be
3589—JJJ paid by the Licensee shall be determined from time to time by the Commission. Whenever such reservoir or other improvement is constructed by the United States, the Licensee shall pay similar charges into the Treasury of the United States upon bills rendered by the Commission.

ARTICLE 9. The Licensee shall pay to the United States as reimbursement for the cost of the administration of the Act, an annual charge of One Hundred Dollars ($100), such charge for any calendar year to be paid at the end thereof, or within thirty days thereafter, upon bills rendered or approved by the Commission.

ARTICLE 10. With the written consent of the Licensee, the Commission may by order made under its seal, modify, alter, enlarge, or omit, in so far as authorized by law, any one or more of the conditions or provisions of this license.

ARTICLE 11. The rights of the Licensee and of its transferees, assignees, or successors acquired by this license shall absolutely cease at the end of the period thereof, unless a new license shall be issued pursuant to then existing laws and regulations.

ARTICLE 12. The provisions of Section 16 of the Act, all provisions reserving any power of taking over the project by con-

demnation proceedings, and all applicable provisions of law, including the Act, providing remedies to the United States for the violations of the terms and conditions of this license, shall remain applicable thereto.

3589-KKK In witness whereof, the Federal Power Commission has caused its name and seal to be hereto signed and affixed by its this day of pursuant to authority given at its meeting of a certified copy of the record thereof being hereto attached.

FEDERAL POWER COMMISSION,
By ——— ———.

3589-LLL In testimony of acceptance of all the terms and conditions of the foregoing license, the Licensee, this day of has caused its name and corporate seal to be hereto signed and affixed by its pursuant to a resolution of its board of directors passed on the day of , a certified copy of the record thereof being hereto attached.

APPALACHIAN ELECTRIC POWER COMPANY,
By ——— ———, *President.*

Attest:

——— ———, *Secretary.*

3590 *Defendant's exhibit No. 538*

NOVEMBER 8, 1930.

EP-739-Virginia—Appalachian Electric Power Company

DEAR GENERAL BROWN: I have Colonel Kingman's letter of November 7 regarding the approval of the plans for the project on New River near Radford, Virginia, contemplated by the pending license application (No. 739) of the Appalachian Electric Power Company.

In preparing this case for presentation to the Commission for final action a question has been raised regarding the formal finding made by the Commission on June 1, 1927, that the portion of New River embracing the proposed project works is not "navigable waters" within the definition of the act. This finding was made pursuant to the recommendation of your office included in report of December 29, 1925.

For your information I am inclosing a copy of my memorandum of October 30 to the Acting Chairman of the Commission, together with copies of the two memoranda referred to therein. These papers will serve to explain the question which has been raised regarding the nonnavigability finding. It will be much appreciated by the Commission if at your early convenience you will

review the inclosed material in so far as it relates to this point and advise whether there is anything therein presented which would cause you to change or modify the previous conclusion of your office.

Very truly yours,

F. E. BONNER, *Executive Secretary.*

The CHIEF OF ENGINEERS,
*War Department.*

Incl. 1090.
FEB: ARH.
3 copies to the Chief of Engineers.

3590–A *Defendant's exhibit No. 539–A*

Letter by Federal Power Commission of December 15, 1930, signed by F. E. Bonner, Executive Secretary, to Curtis, Mallet-Prevost, Colt & Mosle. (Original Exhibit.)

3591 *Defendant's exhibit No. 539–B*

"Inclosure 7992, from Federal Power Commission, U. S. Government Printing Office 1927." Marked Copy. War Department office of Chief of Engineers, Washington, 11/11/1930 addressed to Federal Power Commission, signed "Lytle Brown, Major General, Chief of Engineers."

3592 *Defendant's exhibit 539–B*

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
*Washington, November 11, 1930.*

The EXECUTIVE SECRETARY,
FEDERAL POWER COMMISSION,
DEPARTMENT OF THE INTERIOR,
*Washington, D. C.*

DEAR SIR: 1. Your letter dated November 8, 1930, referred to this office certain memoranda relating to the proposed license to the Appalachian Electric Power Company, Project 739, for a power development in the New River near Radford, Va. The letter specifically requests that this office review the above material, so far as it relates to the navigability of the New River, with a view to determining if it is desired to modify the opinion expressed in the report to the Commission dated December 29, 1925.

2. After a careful consideration of the material submitted, I have reached the conclusion that there is no reason for changing the previous report of this office dated December 29, 1925, with respect

to the navigability of New River. It is my opinion that New River is not navigable at any point in its course.

Very truly yours,

(Signed) LYTLE BROWN,
*Major General, Chief of Engineers.*"

3593 *Defendant's exhibit No. 540–A*

Letter dated 11/28/1930 from F. E. Bonner, Exec. Secy. of F. P. C. to A. E. P. Co. (Original Exhibit.)

*Defendant's exhibit No. 540–B*

Certified copy of action of the Federal Power Commission upon application of the defendant for Minor Part license. (Original Exhibit.)

Exhibit 540–B is included in Plaintiff's Exhibit 91 and is set forth at page 2506 hereof, but, unlike Exhibit 91, was admitted in evidence for all purposes.

3593–A *Defendant's exhibit No. 541*

FEDERAL POWER COMMISSION,
*Washington, October 28, 1930.*

Memorandum for the Executive Secretary:

1. In his memorandum for the Executive Secretary of October 21, 1930, the Acting Chief Counsel advances three reasons why, in his opinion, a minor-part license should not be issued as proposed to the Appalachian Electric Power Company for the construction and operation of its project on New River near East Radford in Pulaski County, Virginia.

His three propositions are:

1st. Evidence that the applicant has complied with the laws of the State of Virginia, as required by section 9 (b) of the Federal water power act is, in his opinion, not satisfactory.

2d. If the applicant has complied with State law, in that he has begun construction to the extent necessary to establish exemption from obtaining a State license, he has, in his opinion, violated the prohibitions of section 23 of the water power act against proceeding without a Federal license and civil and criminal actions will lie against him. Proper steps should therefore be taken to penalize him accordingly.

3d. That the finding of the Commission at its meeting of June 1, 1927, "that said river (New) in the part thereof involved in said declaration is not 'navigable waters' within the definition thereof in said act, but that the interests of interstate or foreign commerce would be affected by such proposed construction" is

wrong; that the finding should now be reversed; and that the Commission should now make a finding that the New River in the part thereof involved in said declaration is navigable waters of the United States.

2. As to the first proposition. The Acting Chief Counsel states:

"From experience it is learned that it is not safe to rely upon unofficial assurances from State officials that the State laws have been complied with. The Commission and its agents must examine the record and the action required, as supplied pursuant to the regulations of the Commission, and must judge for itself whether the compliance is adequate."

3593-B The applicant has submitted the following evidence of its compliance with State law:

(1) Letter signed by the Chairman of the State Corporation Commission, Commonwealth of Virginia, stating that the applicant company has complied with the conditions of the (State) water power act, granting it exemption from the necessity of obtaining a license from that commission.

(2) Certified copy of an opinion rendered by the Judge for the Circuit Court of Pulaski County, Virginia, in a suit brought by the Appalachian Electric Power Company to condemn certain lands for the project now under consideration by the Federal Power Commission.

(3) Certified copy of an order appointing commissioners to fix the value of certain lands to be condemned for the project now under consideration by the Federal Power Commission.

(4) Certified copy of Certificate No. 1 in the Circuit Court for Pulaski County, Appalachian Electric Power Company vs. George H. Miller.

In the opinion rendered by the Judge for the Circuit Court the following conclusions are stated:

"For the foregoing reasons the Court is of the opinion that petitioner has brought itself within section 12 of the Act hereinbefore referred to and may exercise the power of eminent domain without the necessity of obtaining a license from the State Corporation Commission."

In the order appointing commissioners the Judge said:

"The case having been thereupon adjourned, for further evidence and argument on the matters contained in the motion to quash and special plea, to the 7th day of March, 1930, to be determined at Wytheville, Virginia, in vacation of said Judge of said Circuit Court . . . and it appearing from the evidence submitted at the hearing held on February 17, 1930, and at the further hearing held on March 7, 1930, that the petitioner has made the expenditures in the amounts, in the manner, for the pur-

poses, and within the periods required by Chapter 424 of the Acts of the General Assembly of 1928 as a primary condition of exemption from the necessity of obtaining a license under said Act, and it appearing that, in compliance with the further conditions requisite to petitioner's continuing exemption from the necessity of obtaining a license under the said Act of 1928, the petitioner has instituted its condemnation proceedings solely and entirely under the provisions of Chapters 160 and 176 and Acts amendatory thereof as contained in the Code of Vir-
3593–C ginia of 1924 and is not invoking any rights of eminent domain which are conferred by the said Chapter 424 of the Acts of the General Assembly of 1928, and which are not conferred by Chapters 160 and 176 aforesaid, i. e., is not attempting to exercise any of the additional powers of eminent domain conferred by said Chapter 424 and not existing under the law in effect January 1, 1928, and the petitioner has begun actual construction of its water-power development within the period specified by the said Act of 1928, and it further appearing that the petitioner is not required by the Act of 1928 to obtain a license or other authority from the State Corporation Commission, it is so adjudged, ordered and decreed."

Certificate No. 1 states in part as follows:

"Upon a hearing of motion to quash and special plea filed herein, the following facts were established:

"1. Petitioner is a public service corporation engaged within the State of Virginia in the production, transmission and distribution *and distribution* of electric energy generated partly by steam and partly by water power, and is entitled under the laws of the State of Virginia to exercise the power of eminent domain for the purpose of acquiring properties to be used in the production and distribution of hydro-electric power.

"2. The proposed work of petitioner involves the construction of a dam across New River in Pulaski County, Virginia, with an appurtenant power station, and the impounding of the waters of said river, which will submerge or affect the lands of the defendants to the extent proposed to be acquired by the petitioner.

* * * * *

"4. New River is not now, and has never been, navigable in fact, in the State of Virginia.

* * * * *

"11. Petitioner and its predecessor have expended since January 1, 1923, and prior to January 1, 1928, more than $10,000, and since January 1, 1923, and up to this time an aggregate of upwards of $600,000 in investigation, surveys, acquisitions of lands

l construction work in respect to this project, and more than
,000 between January 1, 1923, and the effective date of the
rginia Water Power Act of 1928, in the investigation of, the
uisition of lands and rights for, and the construction of the
said power development.

3-D "12. Physical work necessary in the construction of the
hydro-electric development has been done; explorations
the reservoir site have been carried on with the view of ascer-
ning its suitability in various respects; necessary roadways
ve been built and other necessary roadways reconditioned and
fted for the purpose of bringing materials to be used in the
nstruction work and for other uses in connection with the con-
uction work; holes have been drilled both in the natural rim
the proposed reservoir and also at the dam-site, including the
l of New River at the dam-site, which holes are to be grouted,
at is, will be filled with either liquid cement or asphalt in order
seal the crevices in the rock; the Petitioner has acquired a
ded railroad bed with track thereon leading directly to the
m-site by means of which necessary materials will be taken to
e dam-site and unnecessary excavated material will be re-
oved; although that part of the hydro-electric development
own as the dam has not been erected, there has been done
tain excavation work necessary for the foundation of the dam
the south side of the river and for the power station, includ-
g the stripping of the surface material down to bedrock and
e removal of the inferior surface rock.

* * * * *

"The foregoing, together with those facts set forth in the order
rein, are the material facts proved at hearings upon the motion
quash and the special plea filed in this case.

"Given under my hand this 30 day of May, 1930.

(Signed) HORACE SUTHERLAND, *Judge*."

Here we have a duly constituted court of the Commonwealth
Virginia finding the facts, and from the facts determining
at the Appalachian Electric Power Company by spending cer-
in sums and beginning construction prior to a certain date has
tablishing exemption from the necessity of obtaining a license
om the State Corporation Commission. Further, the court
termines that the company has the right to secure through
ndemnation the lands it needs for the project. Also we have
e letter of the Chairman of the State Corporation Commission
ting that no State license is required.

Are these "unofficial assurances from State officials that the
ate laws have been complied with"?

What better evidence can be obtained? How is the decision of the State court that the company has the right to go ahead with the project even through condemnation, to be set aside?

3593–E 3. As to the Acting Chief Counsel's second proposition.

In the construction industry, work on a project is deemed to have been begun when work which must be done in the prosecution of the work is begun. The construction of roads and railroads, the assembly of plant, construction of camps, and the like constitute a beginning of construction. The expenditures for such work are legitimate charges against the project and are allowed by the Federal Power Commission itself.

The Judge of the Circuit Court of Pulaski County, Virginia, has decided that for purposes of the State water power act the facts establish a beginning of construction by the company.

The Acting Chief Counsel argues that such beginning of construction under State law must be a violation of the prohibition of section 23 of the Federal water power act against proceeding without a Federal license. This is a new and novel idea. Since the New River is not navigable, the United States has no rights for the passage of vessels or floated materials over the bed and banks below ordinary high water. The only right of the United States is that established by the Supreme Court in the Rio Grande case, viz, to prevent any acts which will substantially diminish the navigability of the Kanawha River. The facts established by the Circuit Court of Pulaski County show that no such acts have been committed.

Even if the New River at the site of the project were navigable, the company has built nothing in the river below ordinary high water which would constitute an obstruction to navigation under the Rivers and Harbors Act of 1899, if it were applicable in this case.

Under that act, for example, permits must be obtained from the War Department for the construction of bridges across navigable streams, but the construction of approaches and abutments on private property above ordinary high water, in the expectation of obtaining a permit, can not be held to be in violation of the law.

Even in the administration of the Federal water power act it has not been suggested that an attempt be made to prevent a prospective licensee from going ahead with construction work on private lands, pending issuance of a license for permanent work in the river. Such action would not be in the public interest.

The facts, as established by the State court, demonstrate that no rights of the United States in the New River have been invaded, and it is not apparent how "civil and criminal actions lie"

inst the company or how it is to be penalized as suggested by the Acting Chief Counsel.

3-F 4. The third proposition advanced by the Acting Chief Counsel is that the finding of the Commission, le June 1, 1927, that New River in the part involved in the aration of intention is not "navigable waters" is wrong and uld be reversed.

et us first examine the record as to the finding which it is posed to reverse, and then the purpose of the recommenda- to reverse it.

he declaration of intention of the New River Development npany, predecessor in interest of the Appalachian Electric ver Company, was made to the Commission June 26, 1925.

he second paragraph of section 23 of the Federal water power provides:

That any person, association, corporation, State, or munici- ity intending to construct a dam or other project works across, ng, over, or in any stream or part thereof, other than those ned herein as navigable waters, and over which Congress has sdiction under its authority to regulate commerce between eign nations and among the several States, may in their dis- ion file declaration of such intention with the commission, ereupon the commission shall cause immediate investigation such proposed construction to be made, and if upon investi- ion it shall find that the interests of interstate or foreign mmerce would be affected by such proposed construction, such son, association, corporation, State, or municipality shall not ceed with such construction until it shall have applied for l shall have received a license under the provisions of this act. the commission shall not so find, and if no public lands or ervations are affected, permission is hereby granted to con- uct such dam or other project works in such stream upon mpliance with State laws."

n compliance with this provision of law, a most thorough estigation was made both as to the question of navigability l as to the effect which the operation of the proposed works ght have upon the commerce on the Kanawha River.

The Chief of Engineers of the Army made for the Commission horough study covering the past and present physical conditions the stream, its history, all the Federal laws relating to the eam, and all the decisions of the Supreme Court of the United tes bearing upon the question as to whether it could be held be navigable. In a comprehensive report dated December 29, 1925, the Chief of Engineers, United States Army, stated:

03-G As to navigability

"I, therefore, conclude that New River is not at the present time a navigable water of the United States within the meaning of the Constitution and laws of Congress including section 3 of the Federal Power Act."

And as to the effect upon interstate and foreign commerce

"I, therefore, report that in my opinion New River in its present condition is not a navigable stream and that navigation on the Kanawha River will not be adversely affected by the proposed power development."

On March 2, 1926, the Secretary of War, the Secretary of the Interior, and the Secretary of Agriculture, sitting as the Federal Power Commission, held a public hearing on the effect of the proposed works on interstate and foreign commerce.

On the initiative of the Executive Secretary investigations were made on the Pit River in California to secure data on the propagation of waves down stream from power plants operating on variable loads. The results of these investigations were furnished the Chief of Engineers.

On July 23, 1926, the Chief of Engineers reported that he did not consider the Pit River data applicable to the New River and further stated:

"3. The previous report of this office dated December 29, 1925, on the effect the proposed project would have on navigation in the Kanawha River was based on records of stream flow from 1909 to 1916, inclusive. These records showed that during the period in question the drainage area below the proposed plant would provide sufficient water to meet the needs of navigation in the Kanawha River. The summer of 1925 was exceptionally dry and considerable difficulty was experienced in maintaining navigation in the Kanawha River. It appears, therefore, that at long intervals there may be seasons in which the stream flow is smaller than that covered by the years 1909–1916 and during which the run-off from the area below Radford might be inadequate for navigation purposes.

"4. I, therefore, report that there is reason to believe that in the future exceptionally dry seasons may occasionally occur during which the proposed project near Radford, if unregulated, might adversely affect the navigable capacity of the Kanawha River."

3593–H The facts brought out by the investigation in this case are:

(a) The river was not navigable in fact in its original condition.

(b) All attempts to make the river navigable in fact were unsuccessful.

(c) All acts appropriating money for the improvement of the river were repealed by Congress.

(d) It is well settled by judicial decisions that acts of Congress appropriating money for the improvement of a stream are not to be construed as declarations express or implied that the stream is actually navigable. Congress may authorize the improvement of a nonnavigable stream with a view to creating navigability, yet unless the improvement is accomplished the natural state of the stream is not changed. Whether or not it is navigable is still a question of fact unaffected by the consideration that money has been appropriated and expended in an effort to improve it (Brewer Elliott Gas Company vs. U. S. 260 U. S.).

(e) New River is not now navigable in fact. It is not used or usable for the transportation of persons or property in interstate or foreign commerce.

(f) There is no authorization by Congress for its improvement.

(g) There is no recommendation before Congress for its improvement.

(h) In the future, exceptionally dry seasons may occur during which the proposed project, if unregulated, might adversely affect the navigable capacity of the Kanawha River.

On the foregoing facts, fully supporting a finding of "not navigable," the Commission on June 1, 1927, made its finding "that said river in the part involved in said declaration is not 'navigable waters' within the definition thereof in said act, but the interests of interstate and foreign commerce would be affected by such proposed construction."

3593-I Heretofore the administration of the Federal water power act with respect to projects on nonnavigable streams which might have an effect upon navigation on a navigable stream into which the waters of the nonnavigable stream empty, has been conducted on the following theory of law, viz:

That, since the Government by virtue of the decision of the Supreme Court in the Rio Grande case (U. S. v. Rio Grande Dam & Irrigation Co., 174 U. S. 690) can restrain the acts of the builder of a dam on a nonnavigable portion of a stream in so far as those acts will substantially diminish the navigable capacity of the navigable portion of the stream below, the Federal Power Commission is required to assume complete control over all such projects on nonnavigable streams within the States.

There have been issued by the Commission 30 licenses for projects in navigable streams and 6 licenses under the foregoing theory of law.

The exercise of complete control by the Commission of projects on nonnavigable streams within the States has been protested as exceeding Federal authority by certain State executives and in this case by the applicant company.

The President on July 31, 1930, requested the Attorney General to render an opinion as to whether the Commission is authorized or required to write into the license for this project any provisions other than those necessary to insure such release of water therefrom as will maintain unimpaired the navigable capacity of the navigable waterway below, viz, the Kanawha River, or, otherwise stated, whether all conditions imposed on licensees on navigable streams, including the recapture clause, may be inferred under the facts in this case.

The opinion of the Attorney General was rendered September 22, 1930, and is now available, and states:

"Upon the facts stated by the Commission in this case the United States has no power to prevent the construction of the proposed project on the New River unless its operation will tend to impair the navigability of the Kanawha River by changing the normal and regular flow of the stream; and the only interest which the United States has to protect, and for which it may be justified in issuing a license, is a very minor part of the complete project, viz., the manner in which the flow of the stream below the dam is affected by the operation of the water power. I am advised by a representative of the Commission that under a license providing merely for proper control of the retention and release of water, this project will tend to improve the navigability of the Kanawha River. Under these circumstances every purpose within the power of Congress may be accomplished by the issuance of a minor part license under paragraph (i) of Section 10. Accordingly I am of the opinion that the most reasonable construction of this statute is that paragraph (i) of Section 10 was intended to have application in such a case provided the interests of the United States may be fully protected by the issuance of a license to control the flow of the stream and/or to use physical instrumentalities which may be constructed for this purpose, the conditions of such license to be fixed by the Commission in its discretion under Section 10 (i) of the Act.

3593-J

"This interpretation appears necessary in order to avoid serious questions regarding the constitutionality of the Act which might be presented if Section 10 (i) should be interpreted so as to have no application to projects constructed in or on nonnavigable streams, which only remotely and indirectly affect the navigability of waters in the lower reaches of streams to which they are tributaries. If paragraph (i) of Section 10 is not applicable in such cases the Commission would in no such case be authorized to waive any of the conditions specified in Section 10, because Section 23 prohibits any such construction, once the Commission finds that the interests of interstate or foreign commerce will be

affected, until a license is issued under the provisions of the Act. To hold that the Commission has full authority under this section to exercise its discretion in granting a minor-part license in this case leads to a reasonable construction of the statute and a full accomplishment of its legislative purpose.

"This interpretation of paragraph (i) of Section 10 finds some support in the administrative construction of the Act adopted by the Commission on May 23, 1925, in its consideration of several applications (Project No. 15) of Hydraulic Race Company and other corporations, reported in the Fifth Annual Report of the Federal Power Commission, 1925, at pp. 111 and 112.

"In answering the questions proposed by the Commission, I have accordingly to advise you that it is my opinion that the Commission may, in its discretion, issue a minor-part license under paragraph (i) of Section 10, for the construction and operation of the project here in question; that it is not required to insert, in a license issued for this project, any conditions (except the fifty-year limitation upon the terms of the license) which, in its judgment, are not necessary or appropriate to fully utilize the waters of the New River in the protection or development of navigation of the Kanawha River."

3593-K Under the law, if the New River in the part thereof involved in this project is declared to be 'navigable waters,' there is no question but that the Commission would be required to write into the license all the provisions contained in the act.

If, however, the finding of the Commission stands, viz, that New River, in the part thereof involved in this case is not 'navigable waters,' the Commission may, in its discretion, issue a license in accordance with the opinion of the Attorney General.

The memorandum of the Acting Chief Counsel is an argument in support of what he considers to be the law on navigability, together with an exposition of what he believes should be the policy of the Government with respect to water power, navigation, flood control, and the financing thereof. It consists of selected citations from court opinions and official reports suitable to his argument. It contains none of the many Supreme Court decisions adverse to his contentions. He presents no new facts. In short, it is not, in my opinion, a sound analysis of existing law, but rather a creed which may be developed into law through a reversal of the finding of the Commission in this case, future findings of the Commission in line w th his views, and by future legislation by Congress and future decisions of the courts in accordance with his suggestion that:

"In view of the challenge to the constitutionality of the Act, I think this an appropriate place to point out the fact that water,

flowing in a great river from State to State, or forming State boundaries in such manner as to be useful to a dozen States, is in itself a commodity in interstate commerce, so as to be an object of Federal concern and legislation quite as lawfully as migratory birds (Missouri v. Holland, 252 U. S. 416) or pests against which Federal quarantine is established. (Oregon-Washington R. & N. Co. v. State of Washington, 270 U. S. 81) This is an idea well worthy of the consideration of the courts."

The memorandum in my opinion establishes no sound grounds for a reinvestigation of the navigability of the New River and a reconsideration of the formal finding of the Commission made June 1, 1927, in accordance with the provisions of the act.

M. C. TYLER,
*Lt. Col., Corps of Engineers, Chief Engineer.*

MCT:ARH.

3593–L *Defendant's exhibit No. 542*

NOVEMBER 8, 1930.

Mr. F. E. BONNER, Executive Secretary,
FEDERAL POWER COMMISSION,
*Interior Building, Washington, D. C.*

EP–739–Virginia—Appalachian Electric Power Company

DEAR SIR: Receipt is acknowledged of your letter of the 31st ult. with enclosed draft of license and likewise of your letter of the 6th inst. with a revised draft.

I am authorized by Appalachian Electric Power Co. to inform the Commission that the revised form of 'minor part' licenses for New River Development No. 6 (Radford, Va.), is satisfactory and that if tendered such a license the power company will accept.

Also I am authorized to state that if such a license is tendered the power company will at once begin the active prosecution of the construction of the project.

Very truly yours,

F. W. SCHEIDENHELM.

PWS–k.
cc—Geo. N. Tidd.
M. F. Millikan.
C., M–P., C. & M.

3593–M *Defendant's exhibit No. 543*

"Maneuvers of dams on Kanawha River during wave test, 1930." (Original Exhibit.)

DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

RECONNAISSANCE MAP

# VIRGINIA–WEST VIRGINIA
## DUBLIN SHEET

SUMMERS
MONROE
GREENBRIER
PENDLETON
ALLEGHANY
BATH
HIGHLAND
WOLF CREEK MOUNTAIN
EAST RIVER MOUNTAIN
ALLEGHANY MOUNTAIN
BRUSHY MOUNTAIN
BIG BEAR MOUNTAIN
LITTLE MOUNTAIN
SECOND MOUNTAIN
NEW RIVER
GREENBRIER RIVER
EAST RIVER
WOLF CREEK
Big Bend (abs.)
(Gilmore abs.)
(Waiteville abs.)
(Lewisburg)
(Rhodell abs.)
(Pocahontas)
(Orientown)
Union
Peterstown
Pearisburg
Glenlyn
Elgood
Wyoming
Cahmore
Lindale
Hogue Store
Poplar Hill
Holly Brook
Kimberling
Peters Forks
Laurel Hill
Narrows
Salt Works
Trevey
Palmer
Ellison
Ellis
Hall
Hayes
Bruce
Rice
Cook
Lick
Mill
Pine
Rocky
Big
Little
Dry
Long
Sugar
Indian
Walker
Bear
Deer
Elk
Wolf
Buck
Flat
Cedar
Laurel
Holly
Spring
Meadow
Hollow
Gap
Run
Fork
Creek
Mountain
Ridge
Valley
Knob
Hill
Mills
Store
Church
Cemetery
Tank
Trail
Road
Turnpike
Bridge
Ford
Dam
Mine
Quarry
Oil Well
Gas Well
Spring
Lookout
Tower
Station
Post Office
School
Camp
Ranger
Forest
Boundary
State
County
Township
Railroad
Telegraph
Telephone
Power Line
Contour
Index
Supplementary
Depression
Intermittent
Perennial
Swamp
Marsh
Orchard
Vineyard
Pasture
Meadow
Woods
Brush
Barren
Sand
Gravel
Rock
Cliff
Escarpment
Terrace
Flat
Valley
Basin
Plateau
Peak
Pass
Saddle
Notch
Divide
Slope
Elevation
Relief
Scale
Projection
Datum
Coordinates
Grid
Declination
Magnetic
True
Meridian
Parallel
Quadrangle
Adjoining
Index
Key
Legend
Symbol
Color
Shading
Hachure
Contour Interval
Datum Plane
Mean Sea Level
Vertical Datum
Horizontal Datum
Control
Triangulation
Traverse
Leveling
Photogrammetric
Aerial
Photography
Flight
Strip
Mosaic
Overlap
Sidelap
Tie
Point
Identified
Unidentified
Supplemental
Control
Adjustment
Compilation
Manuscript
Drafting
Scribing
Color Separation
Proof
Publication
Edition
Revision
Date
Surveyed
Compiled
Drawn
Checked
Approved
Director
Chief
Engineer
Topographer
Geologist
Hydrographer
Cartographer
Draftsman
Scribe
Photographer
Operator
Assistant
Party
Field
Office
Washington
Reston
Denver
Menlo Park
Flagstaff
Anchorage
Fairbanks
Juneau
Honolulu
Manila
Guam
Puerto Rico
Virgin Islands
Alaska
Hawaii
Philippines
Pacific
Atlantic
Gulf
Coast
Shore
Island
Reef
Channel
Harbor
Bay
Sound
Strait
Lake
Reservoir
Pond
Stream
River
Creek
Brook
Run
Fork
Branch
Tributary
Mouth
Source
Headwaters
Drainage
Basin
Divide
Watershed
Flood
Plain
Terrace
Delta
Alluvial
Fan
Cone
Crater
Caldera
Volcano
Lava
Flow
Dike
Sill
Fault
Scarp
Fold
Anticline
Syncline
Monocline
Dome
Basin
Uplift
Subsidence
Earthquake
Epicenter
Seismic
Wave
Tsunami
Landslide
Slump
Creep
Erosion
Deposition
Weathering
Soil
Residual
Transported
Glacial
Till
Moraine
Kame
Esker
Kettle
Drumlin
Outwash
Periglacial
Permafrost
Solifluction
Frost
Heave
Thaw
Lake
Pingo
Thermokarst
Aeolian
Dune
Loess
Playa
Alkali
Flat
Evaporite
Salt
Gypsum
Caliche
Laterite
Bauxite
Iron
Copper
Lead
Zinc
Gold
Silver
Uranium
Coal
Lignite
Bituminous
Anthracite
Peat
Oil
Gas
Shale
Sandstone
Limestone
Dolomite
Chert
Flint
Conglomerate
Breccia
Tuff
Basalt
Andesite
Rhyolite
Granite
Diorite
Gabbro
Peridotite
Serpentine
Schist
Gneiss
Quartzite
Marble
Slate
Phyllite
Metamorphic
Igneous
Sedimentary
Fossil
Trilobite
Brachiopod
Mollusk
Coral
Crinoid
Graptolite
Ammonite
Dinosaur
Mammoth
Mastodon
Horse
Camel
Bison
Deer
Bear
Wolf
Fox
Rabbit
Squirrel
Beaver
Otter
Muskrat
Raccoon
Skunk
Opossum
Porcupine
Bat
Mouse
Rat
Vole
Shrew
Mole
Insectivore
Rodent
Carnivore
Ungulate
Primate
Human
Indian
Settlement
Village
Town
City
Population
Census
Boundary
Township
Range
Section
Quarter
Sixteenth
Acre
Hectare
Kilometer
Mile
Foot
Meter
Yard
Inch
Centimeter
Millimeter
Micrometer
Nanometer
Angstrom
Light
Year
Parsec
Astronomical
Unit
Solar
System
Earth
Moon
Sun
Planet
Star
Galaxy
Universe
Big Bang
Theory
Relativity
Quantum
Mechanics
Physics
Chemistry
Biology
Geology
Meteorology
Climatology
Oceanography
Hydrology
Glaciology
Volcanology
Seismology
Paleontology
Archaeology
Anthropology
Sociology
Economics
Politics
History
Geography
Cartography
Surveying
Mapping
Remote
Sensing
Satellite
Imagery
Radar
Lidar
Sonar
GPS
GIS
Database
Software
Hardware
Computer
Internet
Web
Server
Client
Protocol
Standard
Specification
Guideline
Procedure
Method
Technique
Instrument
Equipment
Tool
Material
Supply
Budget
Cost
Schedule
Deadline
Milestone
Project
Program
Plan
Report
Publication
Distribution
Sale
Customer
Service
Support
Training
Education
Research
Development
Innovation
Improvement
Quality
Assurance
Control
Safety
Security
Privacy
Ethics
Law
Regulation
Policy
Agreement
Contract
Partnership
Collaboration
Cooperation
Coordination
Communication
Information
Data
Knowledge
Wisdom
Understanding
Interpretation
Analysis
Synthesis
Evaluation
Decision
Action
Result
Impact
Benefit
Value
Goal
Objective
Mission
Vision
Strategy
Tactic
Operation
Function
Process
System
Structure
Organization
Management
Leadership
Team
Individual
Skill
Experience
Expertise
Professional
Career
Job
Employment
Salary
Benefit
Retirement
Pension
Insurance
Health
Safety
Environment
Sustainability
Conservation
Preservation
Restoration
Management
Planning
Development
Use
Recreation
Tourism
Hunting
Fishing
Camping
Hiking
Boating
Swimming
Skiing
Climbing
Caving
Photography
Painting
Drawing
Writing
Reading
Listening
Watching
Playing
Working
Living
Dying
Birth
Death
Marriage
Family
Friend
Enemy
Love
Hate
Fear
Joy
Sadness
Anger
Peace
War
Life
Nature
God
Universe
Everything
Nothing
Something
Anything
Everyone
No one
Someone
Anyone
Everywhere
Nowhere
Somewhere
Anywhere
Always
Never
Sometimes
Often
Rarely
Usually
Occasionally
Frequently
Infrequently
Regularly
Irregularly
Periodically
Continuously
Intermittently
Constantly
Temporarily
Permanently
Forever
Eternity
Time
Space
Matter
Energy
Force
Motion
Rest
Speed
Velocity
Acceleration
Gravity
Mass
Weight
Density
Pressure
Temperature
Heat
Cold
Hot
Warm
Cool
Freeze
Melt
Boil
Evaporate
Condense
Precipitate
Rain
Snow
Hail
Sleet
Fog
Mist
Cloud
Wind
Storm
Hurricane
Tornado
Thunder
Lightning
Rainbow
Sunrise
Sunset
Day
Night
Dawn
Dusk
Noon
Midnight
Morning
Afternoon
Evening
Hour
Minute
Second
Week
Month
Year
Century
Millennium
Past
Present
Future
Yesterday
Today
Tomorrow
Last
Next
First
Second
Third
Fourth
Fifth
Sixth
Seventh
Eighth
Ninth
Tenth
Eleventh
Twelfth
Thirteenth
Fourteenth
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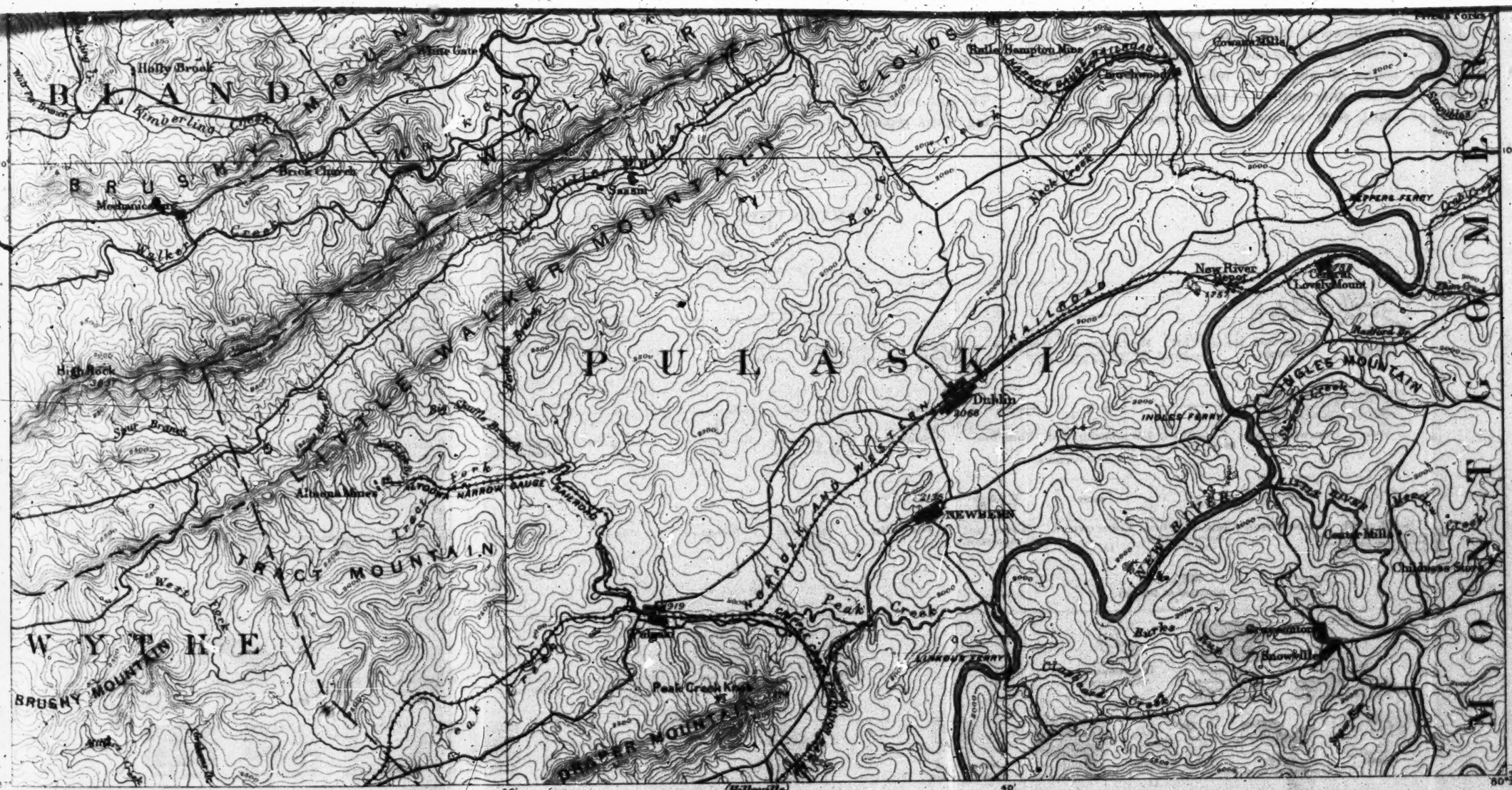
Seventeenth
Eighteenth
Nineteenth
Twentieth
Twenty-first
Twenty-second
Twenty-third
Twenty-fourth
Twenty-fifth
Twenty-sixth
Twenty-seventh
Twenty-eighth
Twenty-ninth
Thirtieth
Thirty-first


BLAND
WYTHE
PULASKI
BRUSHY MOUNTAIN
TRACT MOUNTAIN
PEAKED MOUNTAIN
BRUSHY MOUNTAIN
INGLES MOUNTAIN
Holly Brook
Kimberling Creek
Brock Creek
Mechanicsburg
Walker Creek
Big Rock
Spur Branch
Big Stony Branch
Allisonia Mines
Stony Fork
Wests Fork
Peak Creek Knob
Dublin
NEWBERN
Peak Creek
Peak Creek
Mack Creek
Big Stony Creek
Big Stony Creek
Little Stony Creek
Little Walker Mountain
Walker Mountain
Walker Mountain

# THE TOPOGRAPHIC MAPS OF THE UNITED STATES

The United States Geological Survey is making a standard topographic atlas of the United States. This work has been in progress since 1882, and its results consist of published maps of more than 40 per cent of the country, exclusive of outlying possessions.

This topographic atlas is published in the form of maps on sheets measuring about 16½ by 20 inches. Under the general plan adopted the country is divided into quadrangles bounded by parallels of latitude and meridians of longitude. These quadrangles are mapped on different scales, the scale selected for each map being that which is best adapted to general use in the development of the country, and consequently, though the standard maps are of nearly uniform size, they represent areas of different sizes. On the lower margin of each map are printed graphic scales showing distances in feet, meters, and miles. In addition, the scale of the map is shown by a fraction expressing a fixed ratio between linear measurements on the map and corresponding distances on the ground. For example, the scale $\frac{1}{62500}$ means that 1 unit on the map (such as 1 inch, 1 foot, or 1 meter) represents 62,500 similar units on the earth's surface.

Although some areas are surveyed and some maps are compiled and published on special scales for special purposes, the standard topographic surveys for the United States proper and the resulting maps have for many years been divided into three types, differentiated as follows:

1. Surveys of areas in which there are problems of great public importance—relating, for example, to mineral development, irrigation, or reclamation of swamp areas—are made with sufficient accuracy to be used in the publication of maps on a scale of $\frac{1}{31680}$ (1 inch = one-half mile), with a contour interval of 1, 5, or 10 feet.

2. Surveys of areas in which there are problems of average public importance, such as most of the basin of the Mississippi and its tributaries, are made with sufficient accuracy to be used in the publication of maps on a scale of $\frac{1}{62500}$ (1 inch = nearly 1 mile), with a contour interval of 10 to 25 feet.

3. Surveys of areas in which the problems are of minor public importance, such as much of the mountain or desert region of Arizona or New Mexico, are made with sufficient accuracy to be used in the publication of maps on a scale of $\frac{1}{125000}$ (1 inch = nearly 2 miles), with a contour interval of 25 to 100 feet.

A topographic survey of Alaska has been in progress since 1898, and nearly 37 per cent of its area has now been mapped. About 10 per cent of the Territory has been covered by reconnaissance maps on a scale of $\frac{1}{625000}$, or about 10 miles to an inch. Most of the remaining area surveyed in Alaska has been mapped on a scale of $\frac{1}{250000}$, but about 4,000 square miles has been mapped on a scale of $\frac{1}{62500}$.

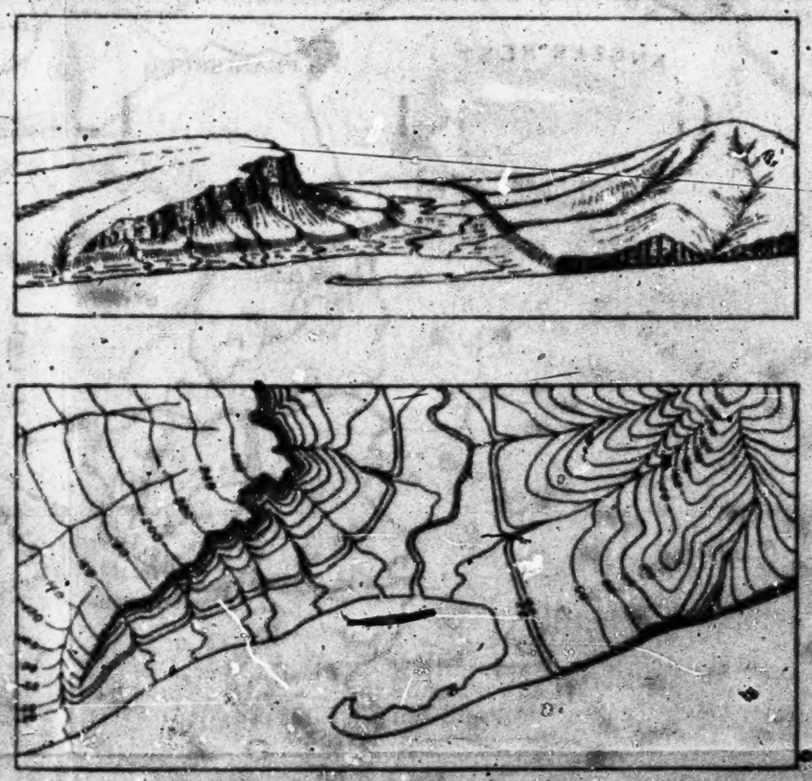
About half of the Hawaiian Islands has been surveyed, and the resulting maps are published on a scale of $\frac{1}{62500}$.

The features shown on these maps may be arranged in three groups—(1) water, including seas, lakes, rivers, canals, swamps, and other bodies of water; (2) relief, including mountains, hills, valleys, and other features of the land surface; (3) culture (works of man), such as towns, cities, roads, railroads, and boundaries. The conventional signs used to represent these features are shown and explained below. Variations appear on some earlier maps, and additional features are represented on some special maps.

All the water features are represented in blue, the smaller streams and canals by single blue lines and the larger streams, the lakes, and the sea by blue water lining or blue tint. Intermittent streams—those whose beds are dry for a large part of the year—are shown by lines of blue dots and dashes.

Relief is shown by contour lines in brown, which on some maps are supplemented by shading showing the effect of light thrown from the northwest across the area represented, for the purpose of giving the appearance of relief and thus aiding in the interpretation of the contour lines. A contour line represents an imaginary line on the ground (a contour) every part of which is at the same altitude above sea level. Such a line could be drawn at any altitude, but in practice only the contours at certain regular intervals of altitude are shown. The line of the seacoast itself is a contour, the datum or zero of altitude being mean sea level. The 20-foot contour would be the shore line if the sea should rise 20 feet. Contour lines show the shape of the hills, mountains, and valleys, as well as their altitude. Successive contour lines that are far apart on the map indicate a gentle slope; lines that are close together indicate a steep slope; and lines that run together indicate a cliff.

The manner in which contour lines express altitude, form, and grade is shown in the figure below.



The sketch represents a river valley that lies between two hills. In the foreground is the sea, with a bay that is partly inclosed by a hooked sand bar. On each side of the valley is a terrace into which small streams have cut narrow gullies. The hill on the right has a rounded summit and gently sloping spurs separated by ravines. The spurs are truncated at their lower ends by a sea cliff. The hill at the left terminates abruptly at the valley in a steep scarp, from which it slopes gradually away and forms an inclined table-land that is traversed by a few shallow gullies. On the map each of these features is represented, directly beneath its position in the sketch, by contour lines.

The contour interval, or the vertical distance in feet between one contour and the next, is stated at the bottom of each map. This interval differs according to the topography of the area mapped: in a flat country it may be as small as 1 foot; in a mountainous region it may be as great as 250 feet. Certain contour lines, every fourth or fifth one, are made heavier than the others and are accompanied by figures showing altitude. The heights of many points—such as road corners, summits, surfaces of lakes, and bench marks—are also given on the map in figures, which show altitudes to the nearest foot only. More exact altitudes—those of bench marks—as well as the geodetic coordinates of triangulation stations, are published in bulletins issued by the Geological Survey.

Lettering and the works of man are shown in black. Boundaries, such as those of a State, county, city, land grant, township, or reservation, are shown by continuous or broken lines of different kinds and weights. Metaled roads are shown by double lines, one of which is accentuated. Other public roads are shown by fine double lines, private and poor roads by dashed double lines, trails by dashed single lines.

Each quadrangle is designated by the name of a city, town, or prominent natural feature within it, and on the margins of the map are printed the names of adjoining quadrangles of which maps have been published. Over 3,000 quadrangles in the United States have been surveyed, and maps of them similar to the one on the other side of this sheet have been published.

The topographic map is the base on which the geology and mineral resources of a quadrangle are represented, and the maps showing these features are bound together with a descriptive text to form a folio of the Geologic Atlas of the United States. More than 200 folios have been published.

Index maps of each State and of Alaska and Hawaii showing the areas covered by topographic maps and geologic folios published by the United States Geological Survey may be obtained free. Copies of the standard topographic maps may be obtained for 10 cents each; some special maps are sold at different prices. A discount of 40 per cent is allowed on an order for maps amounting to $5 or more at the retail price. The geologic folios are sold for 25 cents or more each, the price depending on the size of the folio. A circular describing the folios will be sent on request.

Applications for maps or folios should be accompanied by cash, draft, or money order (not postage stamps) and should be addressed to

THE DIRECTOR,
*United States Geological Survey,*
*Washington, D. C.*

January, 1924.

The features shown on these maps may be arranged in three groups—(1) water, including seas, lakes, rivers, canals, swamps, and other bodies of water; (2) relief, including mountains, hills, valleys, and other features of the land surface; (3) culture (works of man), such as towns, cities, roads, railroads, and hills. In the foreground is the sea, with a bay that is partly inclosed by a hooked sand bar. On each side of the valley is a terrace into which small streams have cut narrow gullies. The hill on the right has a rounded summit and gently sloping spurs separated by ravines. The spurs are truncated at

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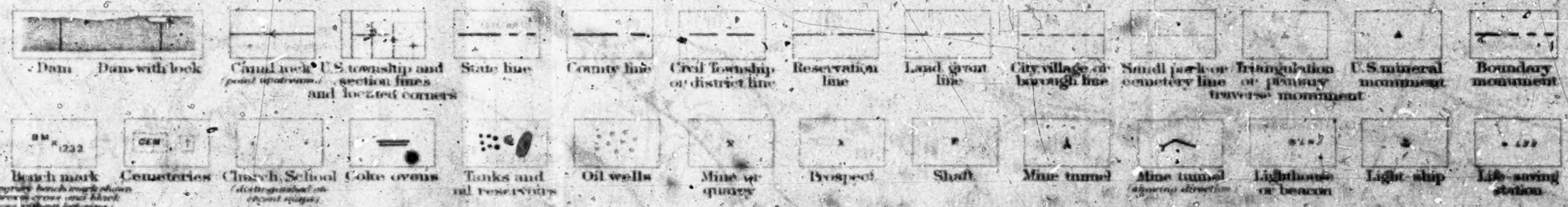
*United States Geological Survey,*
*Washington, D. C.*

January, 1924.

## CONVENTIONAL SIGNS

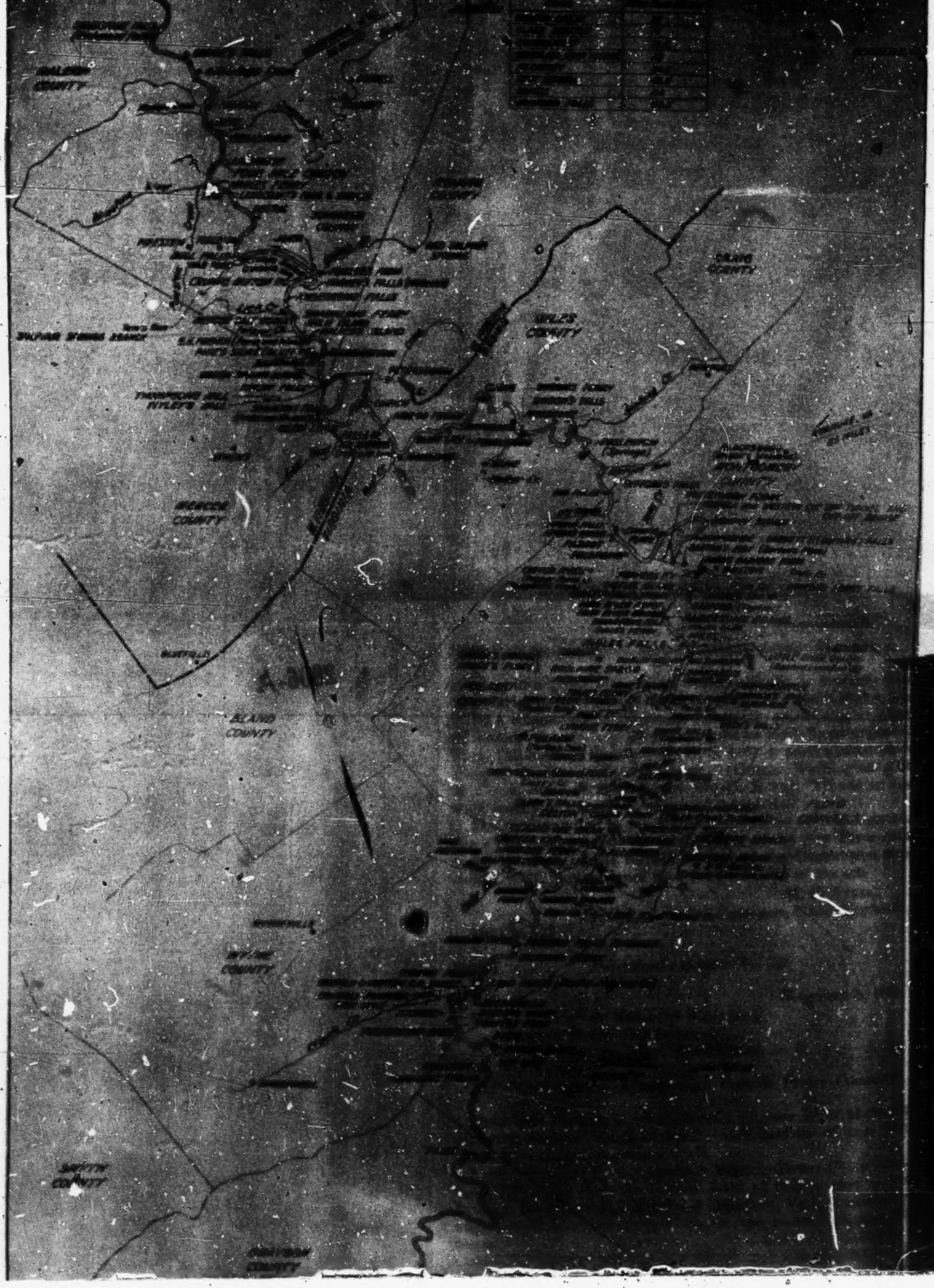
### CULTURE
*(printed in black)*

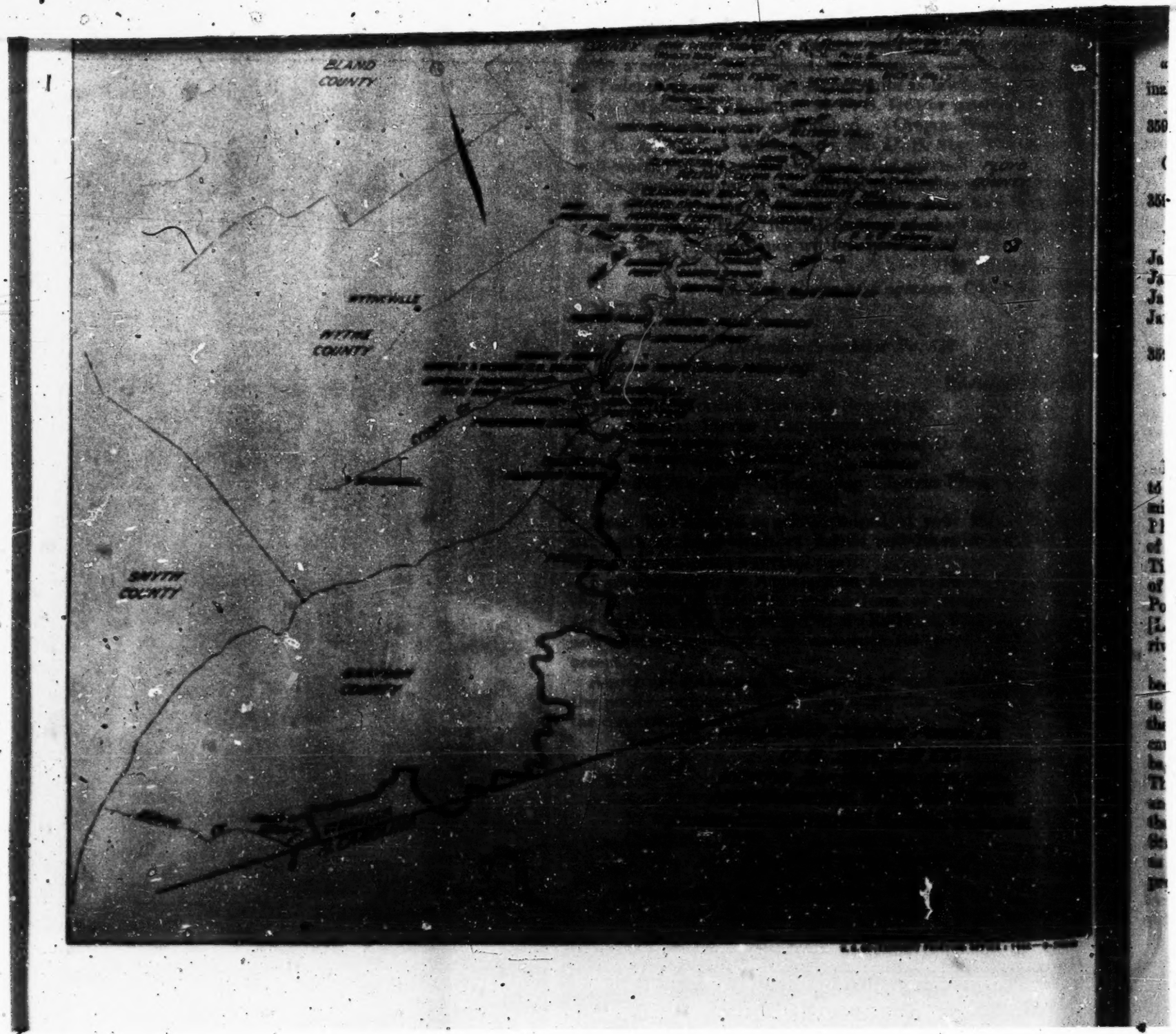



### RELIEF
*(printed in brown)*

### WATER
*(printed in blue)*

### WOODS
*(when shown, printed in green)*




BLAND
COUNTY
WYTHEVILLE
WYTHE
COUNTY
SMYTH
COUNTY

*Defendant's exhibit No. 544*

"Report of Power Waves, New and Kanawha Rivers." (Original Exhibit.)

3593–O *Defendant's exhibit No. 546*

Certificate for W. H. Hundly, East Radford, Va.

3594 *Defendant's exhibit No. 547*

Four pages; namely, page 848 of the Congressional record for January 10, 1901; page 1001 of the Congressional record for January 14, 1901; page 1002 of the Congressional record for January 14, 1901; and page 1096 of the Congressional record for January 16, 1901.

3595 *Defendant's exhibit No. 547*

CONGRESSIONAL RECORD—HOUSE

January 10, 1901—p. 848

Mr. OTEY. Mr. Chairman, I do not rise to make any objection to this bill. I have no objection to the improvement of Buttermilk Channel, Contentnea Creek, Winyah Bay, nor Wappoo Cut. I have no objection to the improvement of those familiar harbors of Annapee, Saugatuck, Menominee, Manitowoc, Kewaunee, and Tillamook. None whatever. They are familiar to every member of this Congress. I have no objection to the improvement of Powow River, Murderkill River, Tickfaw, and Big Sunflower. [Laughter.] But in looking over this bill I find that an important river—New River, Virginia—is not included. [Applause.]

I come before this House (while the appropriation has not been put in the bill and was not recommended by the engineer) to ask for the modest sum of $500,000 for that river; but, like the man and his wife who quarreled whether they should have canvasback duck or terrapin for dinner and compromised on cabbage, I will compromise on $5,000. [Laughter and applause.] This is a very important matter to the people of my district; and since the River and Harbor Committee have met, I bid them be of good cheer on their bill. I intend to vote for those 17 States that are represented on the River and Harbor Committee as well as the 28 States that are not, and especially for the appropriation to those States that get none. I come with a petition

signed by some of the most distinguished gentlemen of the State of Virginia, among whom is the governor of the State, asking for this small sum of $5,000.

I am called away on account of sickness in my family, and therefore I will not be here to present the amendment myself, but I wish to call your attention to the importance of this measure. It is not, understand, any money for any additional improvement.

It is simply to clean out and to repair the channel that has already been made, on which $112,000 has been already expended. There is a balance of $2,800 unexpended, and this means an appropriation of only $2,200. The amendment will be in the words as follows:

"For cleaning out and repairing the deep channel made by the United States Government in New River, Virginia, $5,000."

In my absence that amendment will be presented by another gentleman; and I ask that such fair consideration be given to him as you have always so generously accorded to me. [Applause.]

CONGRESSIONAL RECORD—HOUSE

January 14, 1901—pp. 1001-1002

Mr. OTEY. I gave notice, Mr. Chairman, a few days ago that I would introduce an amendment here for $5,000 for the improvement of a channel already constructed by the United States Government in New River. I come with another compromise this evening, and do not ask for an appropriation at all, but I ask that the $2,300 of unexpended appropriation be expended on that river for the improvement and maintenance of the channel already constructed by the United States Government. They have spent $112,000 on it; they have got a good channel, and work was stopped.

But I wish to read you what is said about that place from a newspaper clipping:

News of Radford—Performance of the launch Altha—Governor Tyler's visit

The launch "Altha," built by Mr. Robert McWane, was placed at the disposal of the business men of Radford Wednesday afternoon in order to show them what an easy thing it is to navigate New River and enlarge the zone of Radford's trade and influence.

The trim little boat behaved beautifully and "walked the waters like a thing of life" as the veteran pilot, Mr. Dudley, guided her through the old Government channels, and showed that by means of very little work the town of Radford could be

made accessible by water to the rich farming lands along the banks of New River miles above the town.

3597 Now, Mr. Chairman, this is a navigable river. When last year we wanted to build a bridge across the river and a dam way up in the mountains the Secretary of War said it was a navigable river and we should not do it, and we had to come to Congress and get a bill passed for that purpose. When we want to build a bridge or a dam it is a navigable river, and when we want to navigate it they tell us it is not navigable. That is what the River and Harbor Committee say. [Laughter.]

Now, I have asked a good many gentlemen about this on the other side of the Chamber, and every one of them have said it was a just thing and ought to be done. I do not ask for any appropriation. I simply ask for the little paltry sum of $2,300 for cleaning out the channel so that a steamboat can go up and down the river. Yes, I have asked nearly everybody I have seen over there, and on this side of the Chamber they are unanimous for it. Why can not we pass it? What is the trouble? [Laughter.]

It is very seldom I ask a favor, and I think now you will come and help me to get this little paltry sum put upon this bill, not as an appropriation, but simply to extend that which is already there.

The CHAIRMAN. The question is on the amendment offered by the gentleman from Virginia.

Mr. BURTON. Mr. Chairman, this was a project that was practically abandoned ten years ago. [Laughter.]

Mr. OTEY. What did the gentleman say? I was unable to hear.

Mr. BURTON. Well, there are several statements here that I want the gentleman to hear. In the official report of the War Department for 1900, on page 5081, is the following statement:

New River, Virginia and West Virginia.—No work has been done on this river since 1889, and the cost of further improvement would be out of all proportion to the benefits to be conferred. Captain Hodges states:

"Work on this improvement has ceased for ten years, during which time there have been no funds appropriated, although there has been a balance of about $2,300 on hand. Under date of April

3598 17, 1891, Gen. (then Col.) W. P. Craighill, Corps of Engineers, reported against further expenditure on the river, stating in substance that the railroads had taken most of the trade which could be accommodated by the river if improved according to the existing project by open-river regulation, and that the time was not yet ripe to initiate more expensive improvements by locks and dams, which alone could restore the importance of the waterway.

"There is no reason at present to depart from the views stated in his report.

"The expense of further improvement of the stream, even under the present project, is very large in proportion to the results attained, since a great deal of rock excavation must be done, while the cost of canalizing the river would be out of all relation to the benefits to be derived now or in the near future.

"Under date of June 27, 1899, authority was received from the Chief of Engineers to drop this work from annual and monthly reports subsequent to those rendered in July, 1899."

Mr. OTEY. Will the gentleman permit a question?

Mr. BURTON. Yes.

Mr. OTEY. What was the name of the engineer which the gentleman gave?

Mr. BURTON. Gen. W. P. Craighill.

Mr. OTEY. Did he know anything about this steamboat? [Laughter.]

Mr. BURTON. I think he did.

Mr. OTEY. Well, the steamboat was not built till two or three months ago. [Laughter.]

Mr. BURTON. Was it a phantom ship or a real ship?

Mr. OTEY. This is a real boat. I have just read the article where the governor was present after the boat was built and when she was launched.

Mr. BURTON. This item is included with some nine or ten others, on page 86, to be repealed and the amount of the appropriation covered back into the Treasury. The committee thought it was time to take up a few of these projects which it was thought were impracticable, or, I might say, absurd, and cover the money back into the Treasury.

I want to say to the gentleman from Virginia, further, that $2,300 would be a bagatelle in improving that river, because the improvement, if any should be made, would be rock ex-
3599 cavation, which would cost tens of thousands of dollars even to make a beginning.

The question being taken on the amendment of Mr. Otey, there were on a division (called for by Mr. Otey)—ayes 45, noes 89.

So the amendment was rejected.

CONGRESSIONAL RECORD—HOUSE

January 16, 1901—p. 1096

The CHAIRMAN. The Clerk will proceed with the reading of the bill.

The Clerk read section 7, as follows:

SEC. 7. That the provisions of river and harbor acts heretofore passed providing for the prosecution of work upon the following projects are hereby repealed, and any amounts heretofore appro-

priated for any of the same now remaining unexpended shall be paid into the Treasury of the United States, to wit: Entrance to Point Judeth Pond, Rhode Island; Harbor of St. Augustine, Fla.; Pensaukee Harbor, Wisconsin; New River, Virginia and West Virginia; Cypress Bayou, Texas and Louisiana; Wolf Lake, Indiana; Chippewa River, Wisconsin; Yellowstone River, Montana and North Dakota; Clearwater River, Idaho; Boat railway from the foot of The Dalles Rapids to the head of Celilo Falls, Washington and Oregon.

Mr. OTEY. Mr. Chairman, I move to strike out line 1, page 86. I refer to New River, Virginia and West Virginia.

This, Mr. Chairman, is the first time that I have ever desired to strike out New River [laughter], but I am as much in earnest and as serious about it now as a man who is going to be hung. [Laughter.] It is a matter of great importance that this amount should still be available for the purpose of the improvement of that river. It is an unexpended balance of but $2,300, and the Treasury of the United States does not need it at all. The report of the engineer in charge of the work some years ago, which indicated that there was no need for using it, was made so
3600 long ago that conditions have materially changed, and the steamboat that is on that river now is necessary for the transportation of the traffic along its banks.

The improvement of this stream is just as important as the improvement of other rivers embodied in this bill. The chairman of the committee has not seen this river. Some people call it a little creek, but the longest iron bridge in the State of Virginia crosses this stream at Radford, and all that is necessary to make the river available for the commerce upon its banks is the utilization of this $2,300 to make the navigation possible for that steamboat up and down the stream.

I went to a distinguished member of the River and Harbor Committee—which some gentleman in the rear irreverently calls the "Robber" and Harbor Committee, but which enconium I do not pass upon the committee myself. I went to a distinguished member and he advised me to bring in an amendment, such as I brought in a short time ago, with a request that the River and Harbor Committee would concur in the amendment. But the generalship of the chairman of that committee is a monument to his management. When I expected an avalanche of votes from the other side of the House and a unanimous vote on this side, and when I tried to keep the chairman from doing anything opposed to the amendment, he got up and gave but a word or two, and what was the result? Why, Mr. Chairman, I was routed—horse, foot, and dragoons. [Laughter.]

Now, I do not ask any appropriation, but simply that you strike this out covering that amount back into the Treasury. Why? You cannot use it. We cannot use it there, unless you give the engineer in charge the power to use it. If the necessities of the case demand it, then why not permit him to use it and let the work go on?

I therefore hope that the chairman of the committee will feel some sort of sympathy in this matter, exhibit some human kindness in his soul, and not have the heart to get up and oppose this as he has done heretofore, because this is a provision which stands upon an entirely different footing. This money
3601 has been appropriated. I only ask that you allow it to remain in the bill and strike out this proposition which covers it back into the Treasury.

Mr. BURTON. Mr. Chairman, I notice that this item is up now for the second time. We had a discussion upon the floor upon it, and it was defeated at that time.

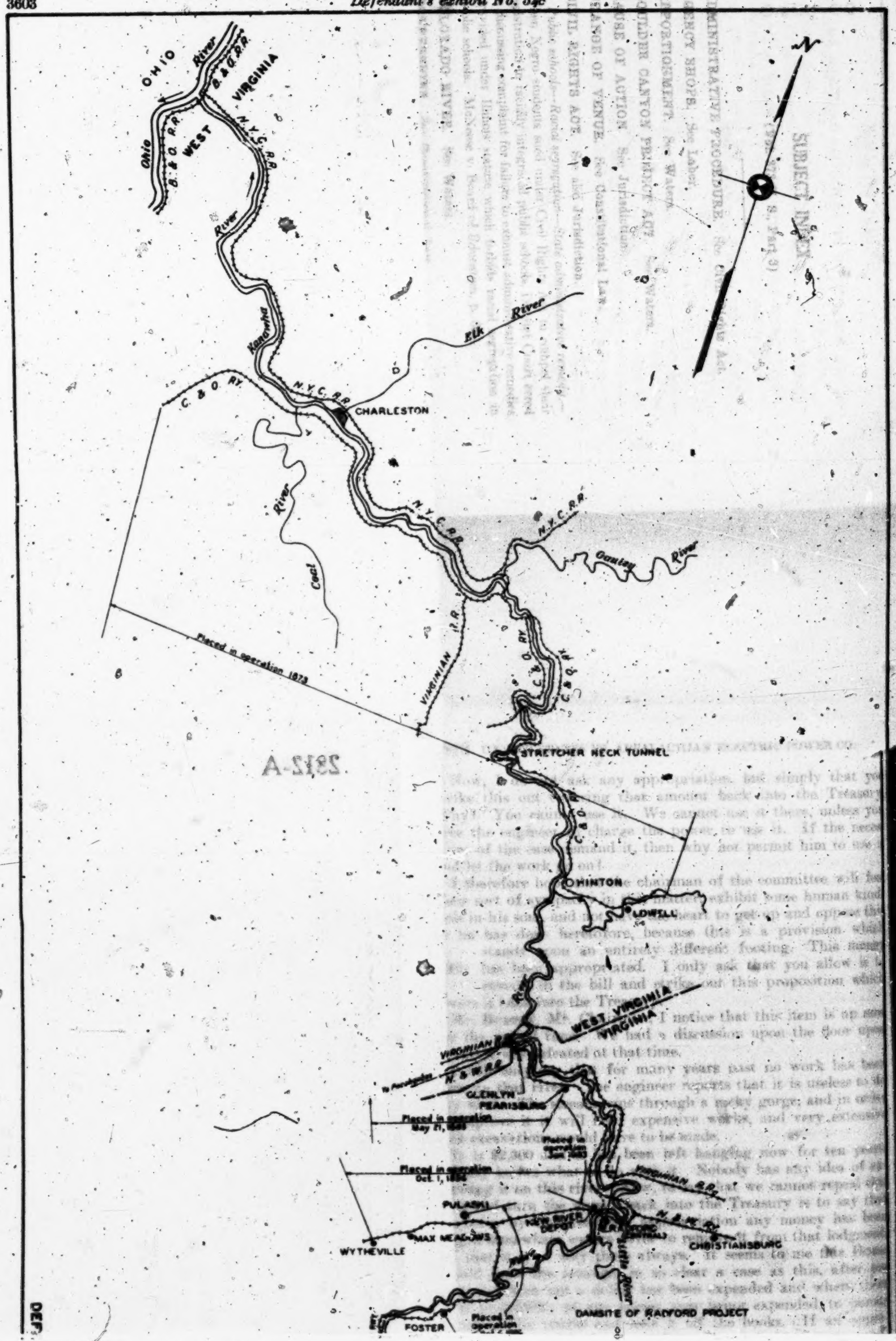
I will only say that for many years past no work has been done on that river. The engineer reports that it is useless to do any work. The stream runs through a rocky gorge, and in order to improve it it will need expensive works, and very extensive rock excavations would have to be made.

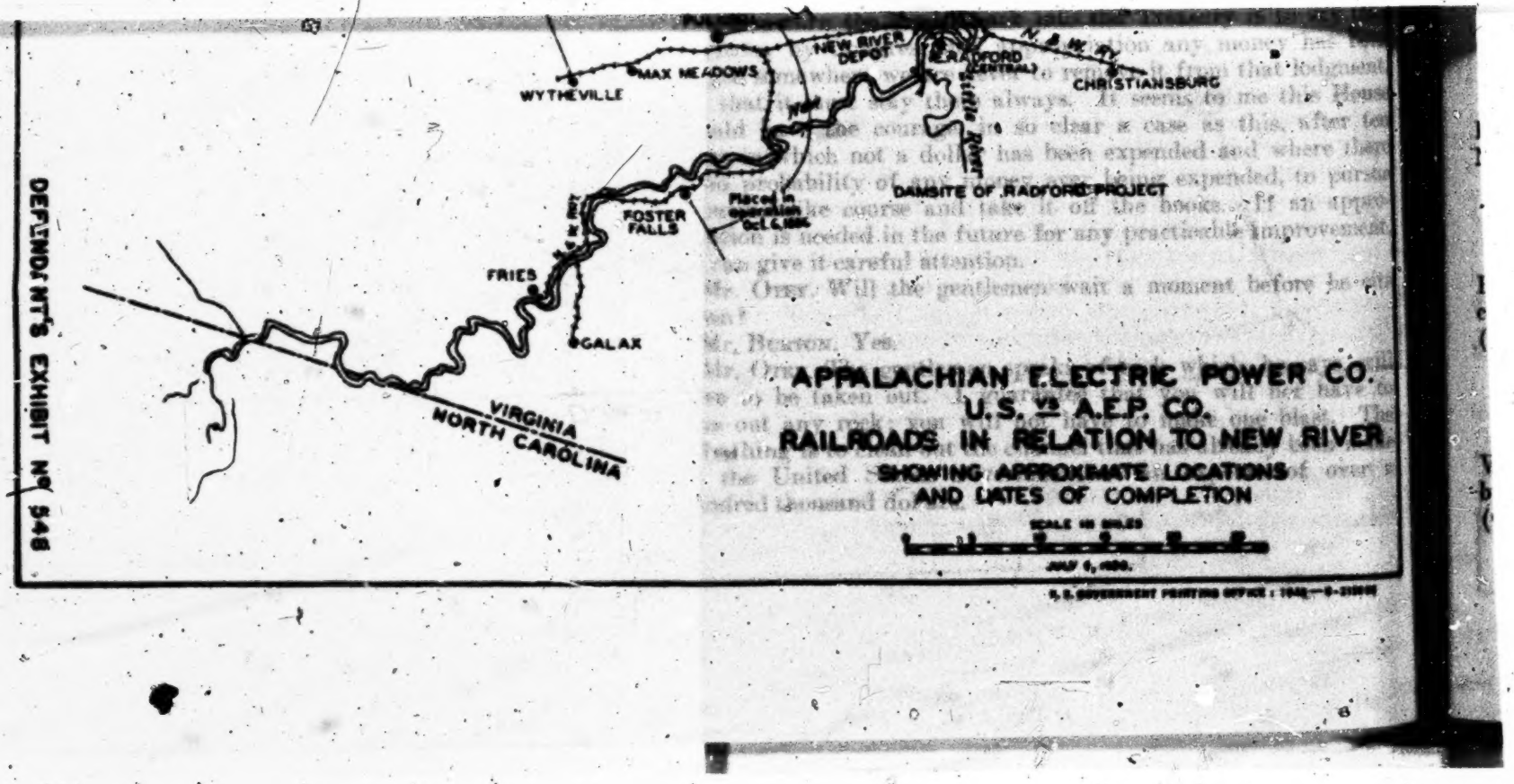
It is $2,300 and it has been left hanging now for ten years. Nobody knows what to do with it. Nobody has any idea of expending it on this river. Now, to say that we cannot repeal this item and turn the money back into the Treasury is to say that whenever by Congressional appropriation any money has been lodged somewhere we are never to remove it from that lodgment, but that it must stay there always. It seems to me this House should have the courage, in so clear a case as this, after ten years in which not a dollar has been expended and where there is no probability of any money ever being expended, to pursue a businesslike course and take it off the books. If an appropriation is needed in the future for any practicable improvement, we can give it careful attention.

Mr. OTEY. Will the gentlemen wait a moment before he sits down?

Mr. BURTON. Yes.

Mr. OTEY. The gentleman speaks of rock which, he says, will have to be taken out. I guarantee that you will not have to take out any rock; you will not have to make one blast. The only thing is to clean out the channel that has already been made by the United States Government at an expense of over a hundred thousand dollars.


Ohio River
B. & O. R.R.
VIRGINIA
WEST VIRGINIA
N.Y.C. R.R.
Kanawha River
Elk River
C. & O. Ry.
CHARLESTON
Coal River
Placed in operation 1873
VIRGINIAN R.R.
Gauley River
STRETCHER NECK TUNNEL
HINTON
ODWELL
N. & W. R.R.
GLENLYN
PEARISBURG
Placed in operation May 11, 1883
Placed in operation Oct. 1, 1886
PULASKI
NEW RIVER DEPOT
MAX MEADOWS
WYTHEVILLE
CHRISTIANSBURG
FOSTER
Placed in operation
DANSITE OF RADFORD PROJECT


APPALACHIAN ELECTRIC POWER CO.
U.S. vs A.E.P. CO.
RAILROADS IN RELATION TO NEW RIVER
SHOWING APPROXIMATE LOCATIONS
AND DATES OF COMPLETION
SCALE IN MILES
WYTHEVILLE
MAX MEADOWS
NEW RIVER DEPOT
RADFORD (CENTRAL)
N. & W. RY.
CHRISTIANSBURG
Little River
DAMSITE OF RADFORD PROJECT
FOSTER FALLS
Placed in operation Oct. 6, 1886
FRIES
GALAX
VIRGINIA
NORTH CAROLINA
DEFENDANT'S EXHIBIT No. 548

Mr. BURTON. Have you been having an earthquake there to get rid of some of those rocks?

Mr. OTEY. No; but we do not want any rock work done; we just want to clean out the channel that is there.

3602 Mr. BURTON. That does not agree with the engineer's report about that.

Mr. OTEY. That engineer's report was made ten years ago, when you and I were boys. [Laughter.]

The CHAIRMAN. The question is on the amendment offered by the gentleman from Virginia [Mr. Otey].

The question being taken, Mr. Otey demanded a division, but subsequently, pending the announcement of the division, withdrew the demand.

The amendment was rejected.

3605 *Defendant's exhibit No. 549*

Album of photographs. (Original Exhibit.)

*Defendant's exhibit No. 550*

Map "Geological Map of the New River, Cripple Creek region, showing the approximate location of ore openings and properties tributary to the Cripple Creek Extension of the Norfolk and Western Railroad, by E. N. D'In-Villiers, Geologist, 1887." (Original Exhibit.)

*Defendant's exhibit No. 551*

Letter addressed to Dr. J. E. Williams, Dean at V. P. I., Blacksburg, Va., Dated February 2, 1936, and signed by R. J. Noell. (Original Exhibit.)

*Defendant's exhibit No. 552*

Carbon copy of a letter dated March 2, 1936 addressed to Hon. R. J. Noell, East Radford, Virginia, and without signature except "Dean of the College" and bearing the initials "JEW." (Original Exhibit.)

*Defendant's exhibit No. 553*

Letter dated March 4, 1936, from R. J. Holden, Professor of Virginia Polytechnic Institute, Department of Geology Blacksburg, Virginia, addressed to Hon. R. J. Noell, East Radford. (Original Exhibit.)

*Defendant's exhibit No. 554*

Album, together with the identification map and the 60 photographs of New River. (Original Exhibit.)

*Defendant's exhibit No. 555*

Map showing locations of photographs, and photographs Nos. 114 to 127 inclusive, of New River. (Original Exhibit.)

*Defendant's exhibit No. 556*

Annual report of the President and Directors of the Board of Public Works to the General Assembly of Virginia, in pursuance of an Act, entitled "An Act creating a fund for internal improvements." (Original Exhibit.)

*Defendant's exhibit No. 557*

Pages 140 and 141 of the Journal of the Virginia House of Delegates for 1817–18 containing a portion of the Report of the House Committee on Roads and Inland Navigation brought in on January 21, 1818. (Original Exhibit.)

3606 *Defendant's exhibits 558–A to 558–G, inc.*

Map dated November 21, 1912, survey made by Major F. W. Alstaetter, Corps of Engineers. Sheets 1 to 6 inclusive, of the Alstaetter map dated November 21, 1912, marked respectively 558–A to 558–G. (Original Exhibits.)

3606–A *Defendant's exhibit No. 559*

Pages from the Report of the Chief of Engineers for 1875

W 10

EXAMINATION OF NEW RIVER, FROM THE LEAD MINES, IN WYTHE COUNTY, TO THE "MOUTH OF WILSON," IN GRAYSON COUNTY, VIRGINIA

UNITED STATES ENGINEER OFFICE,
*Washington, D. C., February 7, 1875.*

GENERAL: In the River and Harbor bill approved June 23, 1874, provision is made for the examination and survey of New River, Virginia, between the lead mines in Wythe County, and the "Mouth of Wilson," in Grayson County. By your letter the

duty was assigned to me, and I have now the honor to communicate the result of a personal examination.

It was necessary to proceed by rail to Wytheville, and then over a mountain-road about twenty-five miles to Independence, in Grayson County. From this point I visited the river, drove along the banks as far as practicable, and crossed and recrossed it at several points. A cursory examination was made of the copper mines at Ore Knob, and the mineral deposits at some other points.

Returning to Wytheville I visited the lead and zinc mines of Captain Raper, situated on New River, about fourteen miles from Wytheville. The following general description of the river will give an idea of its character.

Two tributary streams, which rise in the mountains of North Carolina, unite on the border of Virginia to form New River. The north fork rises at the base of the Blue Ridge, Ashe County, and the south fork at the foot of Stone Mountain, Watauga County, and they unite about five miles above the mouth of Wilson Creek, in Grayson County, Virginia. From Wilson Creek to the lead mines the distance is estimated at forty miles, and from the mines to Max Meadows, the shipping-point of the Atlantic, Mississippi, and Ohio Railroad (formerly known as the Lynchburg and Tennessee Railroad), the distance is ten miles by the turnpike, but by way of the river the distance to the railroad bridge is thirty miles. This portion of the river has been surveyed, under the orders of Colonel Craighill.

The section of the river between the source and the lead mines flows among ridges of the Appalachian chain, and intersects in its course fertile valleys and hill-slopes, covered with forests of fine timber. Near its course may be observed precipitous cliffs of granite and limestone. Between the terminal points of the survey the river flows rapidly over a rocky bed, composed of the upturned strata of granite, gneiss, mica, micaceous schist, slate, sandstone, limestone, and ferruginous rocks in recurring series, and inclined at every angle from zero to ninety degrees. Portions of the strata may be observed beneath the water, or appearing above the surface, scattered in irregular masses along its course. These obstructions, taken in connection with the rapid descent of the stream, constitute insuperable objections to the improve-
3606-B ment of the natural channel by lateral dams and rock excavation. I saw nothing, however, to justify the conclusion that the river could not be improved by means of locks and dams, and small sections of canals. To determine this question a careful instrumental survey will be necessary. The means at my command being insufficient to defray the expenses of such a survey, I am obliged to confine my report to such facts as seem to establish its expediency.

Although I visited the headwaters of the river during the low-water season, yet I found in both of the forks a considerable volume of rapidly-flowing water, which seemed ample for the purposes of a slack-water navigation. As has been said, a careful survey is necessary to determine the practicability of this scheme, and I will now submit an account of the resources of the section in question, which will enable Congress to determine the propriety of making an appropriation for this object.

General Description—Agricultural and Mineral Resources.

It will not be out of place to notice the salubrity of the climate, which is due to the elevation of the land, the purity of the water, and the absence of marshes. By a survey made in 1826, from Lynchburg—which was placed at 528 feet above the tide—Wytheville was found to be 2,237 feet, and Mount Airy Ridge—the summit of the Atlantic, Mississippi and Ohio Railroad—to be 2,574 feet above the same level.

A recent survey, beginning at Norfolk, places Lynchburg at 522.7 feet; Wytheville, at 2,230 feet; and Mount Airy Ridge at 2,570.7 feet above tide. Between Wytheville and Wilson's Creek the general elevation increases, and the mountain ridges seem to be from 1,000 to 1,500 feet above the valleys. The mountains are, for the most part, well wooded, or cultivated to the tops. The slopes afford good grazing for flocks and herds of meat and horned cattle. The valleys and low hills are extremely picturesque, and are well farmed by a thrifty population. The Hon. A. M. Davis, ex-member of Congress, rates the average yield per acre in Grayson County as follows: Corn, 27 bushels; wheat, 12 bushels; rye, 15 bushels; oats, 25 bushels; buckwheat, 25 bushels; and hay, from 2 to 4 tons. He thinks this average would be doubled with proper tillage, which would follow the improvement of the avenues to market. After leaving Independence and approaching the copper regions of North Carolina, the soil becomes less fertile. Nearly all the agricultural products of Pulaski, Floyd, Carroll, and Grayson Counties, Virginia, and of Ashe, Alleghany, and Watauga Counties, North Carolina, have to be hauled from ten to sixty miles, over mountain roads, and at a cost, in many cases, of from 40 to 50 cents per 100 pounds, and are subject to an additional charge of from 20 to 25 cents per 100 pounds in order to reach Richmond. These rates render exportation from the back counties unprofitable, and they are, except for live stock, shut out from market. The opening of the river would stimulate the cultivation of resources now without value. The timber consists of white, black, and red oak, hickory, chestnut, poplar, and pine, which are found

in large quantities and of considerable size; but, on account of the difficulty of the mountain roads, are now worthless, except for local uses, for fuel or fences.

The agricultural resources are, however, exceeded by the mineral. These extend along the course of the river and beyond the limited section assigned to me for examination. But in all this region the cost of hauling, when added to railroad freights, destroys the profits.

3806-C From Mr. Edward Shelly,—an intelligent land-agent residing at Wytheville—I have the following statement in relation to ores of iron:

"We have of iron-ores, limonite, haematite, black oxide, or magnetic, and other ores in such quantity, they alone might be made the source of wealth and industry, if suitable transportation could be provided. But only a "tithe of those which now spin out a feeble existence" can reach market. Great efforts have been made to economize these ores on the spot, especially in Wythe County, and there has been an outlay of from $150,000 to $200,000 in the erection of blast or smelting furnaces, which are capable of producing about 10,000 tons per annum of the best cold-blast, car-wheel, charcoal-iron, which costs, on an average, $4 per ton for haulage to railroad, or from $40,000 to $50,000 per annum. The following furnaces are in active operation, and are all situated only a few miles from the river, mostly under three miles: Graham & Robinson's, two furnaces; Radford Iron-Works, one ten-ton furnace; Howard & Saunders, one; Painter & Co., one; Huddle, one; Crocket & Sanders, one; Sayers & Oglesby, one; Speedwell, one; some others are in course of erection. Beside the blast-furnaces, several bloomeries and forges exist on or near the river for manufacturing blooms and bars, direct from the ores, or otherwise converting pig-metal."

According to the geological map, the iron lead is one of considerable extent, being found between the headwaters in Watauga and the lead-mines in Wythe, and in Wythe, Pulaski, and Mongomery Counties, varying in width from a half-mile to two miles. It has a general trend northeast and southwest, and a dip at many points of 30° southwestwardly.

In Grayson County, Virginia, and in Ashe and Alleghany Counties, North Carolina, four forges have been opened on the north side of the river, and five on the south side, but in reference to their capacity, or whether they are now in operation, I can say nothing. Captain Raper, the principal proprietor of the Wythe lead and zinc mines, states that the number of iron-furnaces in Wythe County is eight, and that the annual productive capacity of each is about 1,000 tons. Another furnace, now in course of construction, will produce the same amount.

Copper Mines and Mining in Grayson and Carroll Counties, Virginia, and in Ashe County, North Carolina.

About fourteen miles from Independence, at the foot of the hill and near the edge of a small brook, is an abandoned copper-mine. A crushing-mill and grist-mill stand close by. It was stated that this mine had been abandoned on account of litigation in regard to the title. Ore-Knob mine, in Ashe County, North Carolina, is about forty-four miles from Independence, over a tortuous and rugged mountain-road; by the way of the river it is about eighteen miles above the mouth of Wilson Creek, and about three miles back from the river. The company has an office in Baltimore, but the work is managed by the principal proprietor, Mr. James Clayton, who resides at Ore Knob. The company has been extending its property by the purchase of large tracts in Ashe County, and in the adjacent county of Carroll, Virginia, which is said to abound in rich deposits of copper-ore. The vein trends southeast, with a dip nearly vertical, and a width of not less than 8 feet. The ores are either a red or black oxide or "smut," giving an average of about 32 per cent. for the more favorable specimens. The vein is supposed to belong to the cupriferous deposit which is found distributed irregularly as far as Duck River in Tennessee.

The Ore-Knob metal is extracted by a process which has been patented, and which is known as cementation. The process is analogous to that described in elementary works on chemistry under the name of "zinc tree," a familiar but curious illustration of the law of crystallization. The fronds of copper closely resemble those of the fern, having a stem, in some specimens,
3602-D of 1 inch in length, with needles about one-fourth of an inch long, and in color of a bright copper hue. The ore is raised to the top of the hill through shafts about 25 feet deep, and then, after calcining and being reduced to coarse powder, it is conveyed to circular vats or tanks, sixty in number, and arranged in successive tiers on the slope of a hill. The vats contain old iron, upon which, while undergoing oxidation, the crystallized copper accumulates. Mr. Clayton describes the process as follows:

"Our present process of working is a patent of Messrs. T. S. Hunt, of Boston, and Q. Douglass, jr., of Quebec, Canada, and is known as the Hunt and Douglass process of making copper by cementation. Our sulphureted ores are reduced, calcined, and made into oxides of copper. The oxidized ores are charged into vats or tanks into a solution of dissolved salt and copperas, the

mass agitated, and the dissolved copper extracted by precipitation on metallic iron; the liquor is then pumped back and reused, and the operations continued. Our product is now about 120,000 pounds cement copper per month, and when our new works are increased the product will be near or about 200,000 pounds ingot-copper per month."

One hundred pounds of copper may be precipitated by 80 pounds of iron, but in practice 200 to 300 pounds more iron is used. This is occasioned by the free acid as well as the neutral sulphate of iron which dissolves the iron. In a solution containing iron vitriol, an insoluble neutral and insoluble basic salts of peroxide of iron are formed of different composition. Heating the solution facilitates the oxidation of the iron. Mr. Clayton attains this result by passing pipes of steam through the vats. The separation of the peroxide requires further manipulation. The resulting copper-crystallization is not a pure metal, but a sulphide or chloride of copper, and requires further process to separate the copper. The method employed by Mr. Clayton has been in use for some years in Europe.

The average actual product of copper by this process when I visited the mines was about 300 pounds per day. At that time the manager had to contend against several difficulties. The iron used in the process was purchased chiefly in Baltimore, and was hauled forty-four miles over badly-worn mountain roads from Marion, on the Atlantic, Mississippi and Ohio Railroad. The copper had to be hauled back to the same station. The cost per day for hauling to and from Marion is $300, but the number of days actually consumed in hauling is unknown. This expense, which will last as long as iron is required for the reduction of the copper, shows the importance of improved communication by river or rail for the development of the metallic resources of this section of country. During my stay work was suspended on account of the sudden fall of the market value of copper from 30 to 20 cents per pound. This company has made unavailing efforts to induce the railroad to extend a branch to its mines. Unless something is done this important industry must fail for want of proper encouragement. The capital invested in buildings and machinery at Ore Knob amounts to $150,000. Although this company seems willing to continue the contest with the difficulties which surround it, yet the long and necessary haul and the extravagant plan of purchasing the iron used in the reduction of the ore, may in the end prove fatal to the enterprise. Mr. Clayton is now engaged in a search in Wythe County for a suitable locality for an iron-smelting furnace, in order that he

may be able to make the iron required in his process. It is hardly necessary for Mr. Clayton to go so far, as good magnetic iron-ore can be found on the South Fork near Helton Creek, about eight miles distant.

A valuable product, the red peroxide of iron, having the properties and consistence of paint, is now thrown away as useless, the cost of transportation not permitting it to be brought to the railroad. It may seem remarkable that this company, notwithstanding the difficulties above mentioned, is able to compete with the Lake Superior mines, which supply copper of great purity. But the purity and consequent toughness of the lake ores render it extremely difficult to break up the large masses which form the deposit. The ores of Ore Knob and the vicinity are soft and easily reducible, and pay a fair per cent. on the cost when the market-price of the metal is at the average rate.

3606–E

In reference to the cupriferous lands of the company, Mr. Clayton states:

"Our beds are the largest and nearest to tide-water of any yet known, and with any ordinary means of cheap transit we should be able to ship 500 to 1,000 tons pyrites daily. By introducing a cheap supply of sulphur we could reduce the cost of sulphuric acid, decrease the price of superphosphates, and increase the general prosperity of the Southern and Middles States by making available the use of superphosphates. Our present work is only valuable on account of the value of our ores for copper. By increased facilities of transportation we could utilize the sulphur and peroxide of iron which are now worthless and waste products."

## Zinc and Lead Mines

The Union lead and zinc mines are located on New River, about fourteen miles from Wytheville and ten miles from Max Meadows (the shipping-point on the railroad) by an ordinary road.

The distance to the railroad-bridge over New River, by the course of the river, is thirty miles. In this distance the river is obstructed by many ledges of rock and rapids. At Forster's Falls the river has a descent of 18 feet in the distance of half a mile, and Colonel Craighill estimates the cost of a canal at this point at $250,000.

As the country between Max Meadows and the lead-mines is comparatively level, the railroad company would no doubt extend a branch to this point in order to command the trade.

The lead and zinc works are found at the same locality, and belong to the same company. The lead-mines have been in operation more than one hundred years. They were much used during the Revolution and during the late civil war. Since then the lead has become less valuable than the zinc. The ores are chiefly carbonates, silicates, and sulphurets of lead, overlaid by masses of zinc, which last are mined and shipped North in a crude state. I am unable to say why the zinc is not rolled before being shipped, as this would save the loss that must result from the transportation of crude ore. The vein is about 50 feet thick, and is traceable as far as Tennessee. Captain Raper, the principal proprietor, has communicated the following:

"The annual product of this mine for the last few years has been from 200 to 300 tons metallic lead, and we have shipped from 1,500 to 2,000 tons zinc-ore annually. The cost of raising the zinc-ore, which is mined in connection with the mining for lead, is about 50 cents per ton. The cost of manufacturing lead is about $3.75 per 100 pounds. The nominal capital invested is $400,000, divided into 20,000, shares, at $20 each. Rate of wages paid to operatives, from 75 cents to $1.25 per day; tenement-houses, fuel, and pasturage for milch-cows furnished free of rent."

## Trade

In order to present a satisfactory exhibit of the trade of the region covered by my report, I have procured from Mr. E. E. Portlack, auditor of the road, the following statement of tonnage received and sent at and from the undermentioned stations (on the border of the region tributary to New River above the lead-mines) of the Atlantic, Mississippi and Ohio Railroad during the fiscal year ending September 30, 1874:

3606–F

| Stations | In pounds | | Total |
|---|---|---|---|
| | Received | Sent | |
| Dublin | 2,741,280 | 9,105,146 | 11,846,435 |
| Martins' | 410,660 | 1,244,879 | 1,655,530 |
| Max Meadows | 2,768,760 | 10,953,401 | 13,722,161 |
| Wytheville | 5,208,680 | 8,124,658 | 13,333,338 |
| Rural Retreat | 1,213,240 | 1,884,196 | 3,097,436 |
| Total received and sent | 12,342,620 | 31,312,280 | 43,654,900 |

The bulk of the tonnage sent West from Max Meadows is pig-iron, shot and bar lead; of total tonnage sent, 3,235,780 pounds went West.

A classified return of the tonnage sent East over this road during the year ending September 30, 1874, from the aforementioned stations, was also furnished by Mr. Portlack, but being incomplete I have not thought it necessary to submit it. It embraces products of animals, of which the principal are bacon, butter, and lard, eggs, fowls, feathers, fresh meats, wool, cattle, hogs, horses and mules, and sheep; products of agriculture, of which the principal are corn and corn-meal, flaxseed, hay, rye, and other grains, tobacco-leaf, and wheat; products of the forest, including bark, lumber, roots and herbs, and staves; products of manufacture, including bees-wax, flour, shot, and bar-lead; products of the mines, including barytes, iron-pig, lead-pig, plaster, zinc-ore, and other articles. I am satisfied that this statement does not give all the products of the section of country under consideration.

## Conclusion

The conclusion which I desire to present may be summarized as follows:

1. That the portion of New River between the mouth of Wilson Creek and the lead-mines cannot be improved by contracting the channel; erecting lateral dams, and removing the rock, but it may be improved by locks and dams and small sections of canal.

2. That a careful instrumental survey would be necessary in order to determine the feasibility of such an improvement.

3. The actual products, mineral and agricultural, as well as the resources of this region, are of sufficient extent to justify the cost of making a careful survey.

4. In case Congress desires a survey to be made, I respectfully submit the following estimate for that object. But in order that the projected improvement may be available for transporting copper from Ore Knob, I would recommend that the survey be extended for eighteen or twenty miles up the fork on which it is situated. An examination of the same distance on the South Fork would penetrate to the Helton Iron Furnace. The entire length to be examined on both forks and on the river would then be about eighty miles.

The estimate is as follows, made on the basis of ninety working days of field-work:

| | |
|---|---|
| 2 assistants, at $150 each, three months | $900 00 |
| 4 rodmen, at $70 each, three months | 840 00 |
| 3 ax-men, at $30 each, three months | 270 00 |

| | | | |
|---|---|---|---|
| 3606–G | 3 canoes and boatmen, $45 each, three months | | $405 00 |
| | 4-horse wagon, at $150 a month, three months | | 450 00 |
| | 1 cook, at $35, and 1 caterer, at $35 a month, three months | | 210 00 |
| | Subsisting 14 men and 4 horses three months, at 50 cents per day | | 810 00 |
| | Transportation of party to point and back | | 210 00 |
| | Instruments, transit, level, rods, chains, &c | $700 00 | |
| | 3 tents and camp-equipage | 150 00 | |
| | Cooking utensils, tools, &c | 100 00 | |
| | | | 950 00 |
| | Completing maps and reports, and note-books and stationery | | 455 00 |
| | Total | | 5,500 00 |

Very respectfully, your obedient servant,

S. T. ABERT,
*U. S. Civil Engineer.*

Brig. Gen. A. A. HUMPHREYS,
*Chief of Engineers, U. S. A.*

3607 *Defendant's exhibit 560*

REPORT OF THE CHIEF OF ENGINEERS—YEAR 1887

(pp. 251–253; 1925–1926; 1927–1929)

3. New River from the mouth of Wilson, in Grayson County, Virginia, to the mouth of Greenbrier River, West Virginia. The appropriations have been made in such manner as to divide this portion of the river into three sections, as follows:

| | Miles |
|---|---|
| Upper, or Lead Mines | 62 |
| Middle, or New River Bridge | 43 |
| Lower, or Greenbrier | 86½ |

Throughout this distance the navigable channel consisted of natural chutes through the ledges and shoals of varying widths, rarely over 1 foot in depth, in some places so tortuous as to render navigation extremely difficult and dangerous.

The original project adopted for the improvement of these natural channels was to widen them to 30 or 50 feet, as might be required, deepen them to 2 feet, and straighten such as needed it. This was for bateau navigation; the improvement, however, to be made in such a manner as to aid the work should a greater depth and width be required in the future.

A small steam-boat, draught 12 inches when light, having been built at Hinton, in the fall of 1878, rendered it necessary to make the channel in that section 50 feet wide at all points, and in many from 75 feet to 100 feet, the depth of 2 feet being retained. This steam boat was not adapted in dimensions and power to the navigation of the river, and was withdrawn.

The original plan of improvement has been adhered to, except that the width of channels on the middle and upper divisions has been reduced to 20 feet, and on the former to 10 feet for several miles, to allow iron to be shipped from the furnaces above.

There was no appropriation for this river in 1883, 1884, or 1885. July 1, 1886, there was a balance remaining unexpended of $3,000 from the appropriation of August 2, 1882. This pertained
3608 by special designation of the law to the portion of the river above Foster's Falls, which are not passable. The balance remained unexpended because of the impassibility of these falls. As the disconnection with routes of transportation caused by these falls would practically disappear on the completion of the railroad up Cripple Creek, and as boats could then ship to the railroad their freight at Porter's Ferry, above the lead mines and the falls, it was concluded to improve the condition of Williamson's Ledges and Shoals. This work was continued as late as the season allowed, a small balance of funds being left unexpended, but not large enough to justify the resumption of operations in the summer of 1886.

The navigation of the river not being continuous as yet, it is practically a feeder to the railroads which cross it and run along portions of it. It has also been of much use in carrying materials and supplies to the railroads while in process of construction near it. It is probable that when the river is fully improved boats will transport one-third of the products of the fine agricultural country through which it flows, and seven-eighths of those of the mines, exclusive of coal.

There was an appropriation of $10,000 in the law of August 5, 1886, applicable only to the portion of the river above the lead mines. When the money became available it was too late to commence operations in 1886. For more than one reason it seemed inexpedient to spend this appropriation in 1887. The portion of the river to which it is applicable is above Foster's Falls, and these can only be passed by one or two locks at a cost much greater than Congress is likely to authorize. There is also strong reason for doubt whether, considering the present development of that section of the country, the construction of such locks would be justifiable even if the money were available. The construction of railroads near this stream has for the present diminished very much the importance of the improvement of the portion above Foster's Falls. After a careful re-examination of the subject, and a reconnoissance of the river and its vicinity, it was decided to postpone the expenditure of the appropriation.

| | |
|---|---|
| uly 1, 1886, amount available | $466.57 |
| mount appropriated by act approved August 5, 1886 | 10,000.00 |
| | 10,466.57 |
| 009 July 1, 1887, amount expended during fiscal year, exclusive of liabilities outstanding July 1, 1886 | 244.28 |
| July 1, 1887, amount available | 10,222.29 |
| Amount (estimated) required for completion of existing project | 120,000.00 |
| Amount that can be profitably expended on lower river in fiscal year ending June 30, 1889 | 20,000.00 |

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867.

## E E 3

### IMPROVEMENT OF NEW RIVER FROM THE MOUTH OF WILSON, IN GRAYSON COUNTY, VIRGINIA, TO THE MOUTH OF GREENBRIER, IN WEST VIRGINIA

After a suspension of operations for some years for want of funds an appropriation of $10,000 was made August 5, 1886, applicable, however, only to the portion of the river above the lead mines.

Doubt having arisen in view of the changed condition of affairs on and near the river as to the propriety of expending this appropriation at once, a special report was made to the Chief of Engineers May 19, 1887, as follows:

Referring to my request of April 8, approved April 13, for authority to have a reconnaissance made of New River, Virginia, above the lead mines in Wythe County, I have the honor to state that I employed for that purpose Mr. W. Proctor Smith, formerly of the Corps of Topographical Engineers, who had made a survey of that part of the river in 1878. His report of the survey may be found in the Annual Report of the Chief of Engineers for 1879, part 1, pages 538–545.

Previously an examination of the same portion of the river had been made by Mr. S. T. Abert, whose report, dated February 7, 1875, is in print in the Annual Report of the Chief of Engineers for 1875, part 2, pages 133–139.

Both of the reports referred to give much important information concerning the part of the river to which they relate. The former contains three estimates for the improvement of this stretch of the river of 62 miles as follows:

| | |
|---|---|
| (1) For a 2-foot navigation for push boats 60 feet long, 7 feet wide, and carrying about 6 tons, with a channel not less than 30 feet wide, with tracking and towing paths at the falls and rapids | $115,000 |
| (2) For a steamboat navigation, with a channel 90 feet wide and not less than 3 feet deep, with a grade always less than 1 in 400, including 23 locks and dams | 1,200,000 |
| (3) For a 5-foot stream navigation | 1,600,000 |

Colonel Smith has lately inspected the upper river and submits a report, dated May 18, of which a copy is herewith.

3610 Reference is requested to what was printed concerning New River in the Annual Report of the Chief of Engineers for 1886, which need not be now repeated.

Up to July 1, 1886, the money available for the upper portion of the river had amounted to $10,000, of which there had been expended $9,533.43, leaving a balance of $466.57.

In the law of August, 1886, there was a new appropriation of $10,000.

The season for work in the river in that section is short and it was too late to make economical beginning after August, 1886.

For reasons often mentioned in annual and special reports, no attempt has been made to give a continuous navigation of the New River (which rises near the line between North Carolina and Virginia, runs nearly north, receiving many tributaries) to Hinton, on the Chesapeake and Ohio Railroad, where the Greenbrier empties into it. A short distance above the Falls of the Great Kanawha River it united with the Gauley to form the Great Kanawha River. The part of the river below Hinton is incapable of being navigable except at very great expense, and by resorting in some places to side canals. The Chesapeake and Ohio Railroad, now become a trunk line, is built upon the bank of the river below Hinton.

The portion of the river from the northern border of North Carolina to Hinton flows through a very picturesque country, sparsely populated, but containing a great and varied store of useful minerals, in some parts covered with large tracts of valuable timber, in others admirably adapted to agriculture and grazing. The most serious obstacle to a continuous navigation of the river above Hinton is Foster's Falls, which isolate the lead mines section from that immediately below.

Estimates for the improvement of the river above Hinton to the lead mines have been given in previous reports. These may be found in the Annual Report of the Chief of Engineers for 1873, pages 842–854.

As Congress has never given such a sum of money as would justify the proper beginning of a connected project for a continuous navigation from the North Carolina border to Hinton, the effort has been to apply such funds as were supplied in ameliorating the condition of the river and facilitating its use as a means of enabling the people to carry their salable products to the railroads which were in connection with the great markets of the Atlantic and the valley of the Mississippi. In carrying out this idea, there has been spent in the past ten years the sum of $58,000 in improving the portion of the river in the

vicinity of New River Bridge, which is the point of intersection with the Norfolk and Western Railroad. The sum of $34,000 has been similarly spent on the portion of the river called the lower or Greenbrier section, which reaches the Chesapeake and Ohio Railroad at Hinton.

The question now is as to the best use to be made of the late appropriation of $10,000, which by the terms of the law can only be spent above the lead mines. As it is not likely Congress will in the near future supply the money necessary to make Foster's Falls passable and thus connect the upper and middle sections, it is supposed the same policy should continue of partial improvement in connection with the railroads. While there is much development in progress and more in prospect for the country on and near this upper section, yet the recent examinations of Colonel Smith seem to indicate that while the rafting of timber would be facilitated by spending the available $10,000 in the method suggested by him, that kind of navigation is already practicable, and the expenditure of the money would not be advantageous to any important extent to navigation by push-boats. Under all the circumstances it seems unnecessary to spend $10,000 on the upper New River in 1887, and it is accordingly recommended that the money be held in reserve.

3611 The recommendation to refrain from expending the money was approved. It may be added that the improvement of New River above the point to which it has now been carried would be quite expensive, requiring a very heavy excavation of rock. It would be a very uneconomical proceeding to spend the available appropriation in view of the very small benefit it would cause. It does not revert to the Treasury at present.

Precise statistics could not be obtained for the last fiscal year for the reason that, no work having been in progress, there has been no one to collect them from the individual owners of the bateaux, that alone are employed in the navigation of the river.

Money statement

| | |
|---|---|
| July 1, 1886, amount available | $466.57 |
| Amount appropriated by act approved August 5, 1886 | 10,000.00 |
| | 10,466.57 |
| July 1, 1887, amount expended during fiscal year, exclusive of liabilities outstanding July 1, 1886 | 244.28 |
| July 1, 1887, amount available | 10,222.29 |
| Amount (estimated) required for completion of existing project | 159,000.00 |
| Amount that can be profitably expended on lower river in fiscal year ending June 30, 1889 | 20,000.00 |

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867.

3611-A BALTIMORE, MD., *May 18, 1887.*

SIR: In compliance with your instructions to examine the resources and commerce of the section of country in Virginia through which New River runs, between the mouth of Wilson Creek and the lead mines, a distance of 62 miles, to ascertain, whether they would warrant the expenditure of the $10,000 appropriated by Congress in August, 1886, I have the honor to report that on Monday, April 25, I went to Wytheville, Va., and thence to Ivanhoe Furnace, in Wythe County, on New River, 2.6 miles above the lead mines.

Making the furnace my starting point, I examined the country by making frequent horse-back trips, and find as follows: That in 1885-86 a branch railroad was built from Martin's Station (now Pulaski City), on the Norfolk and Western Railroad, to a point on the river 23 miles above New River Bridge, and about the same distance by rail; thence the road was continued up to Foster's Falls (6 miles below the lead mines) when it stopped.

Much work was also done on this road between Foster's
3611-B Falls and Ivanhoe Furnace, which is to be resumed at once and completed this fall. Ivanhoe Furnace is 2 miles above the mouth of Cripple Creek, up which the railroad is to run, and is now called by its name.

This road is built principally to get at the iron, lead, zinc, copper, and other metals in this section. The charcoal furnaces are to be changed to coke.

Abundance of timber; oak, black, white, and red; pine, white, and yellow; and hemlock, poplar, lynn, and chestnut. Some of this is found at Crooked Creek, but the forests get heavier at and above the mouth of Chestnut Creek, 8 miles above Ivanhoe Furnace; thence the timber continues all the way up the stream and in large quantities in Alleghany, Ashe, and Watauga counties, North Carolina. The Carroll County Mineral Company owns 450 acres on Crooked Creek, 4 miles up; and 730 acres on Chestnut Creek, 5 miles up, which comes to within 1½ miles of the river at Dixon's, 10.8 miles above the furnace; this property is full of black oxide and sulphate of copper and some iron.

The great magnetic vein of iron ore which runs through the country crosses the river here, and is now being developed, as it is also 2 miles above. Further up the stream there is plenty of copper; in fact minerals and timber abound beyond the usual amount found in any section of the same dimensions.

As regards the commerce proper of this section, I may say that through the mountains there is little else for transportation than timber and minerals; food supplies have frequently to be brought there.

Above the mountains the people raise some little more breadstuffs than they use, which are sold in North Carolina, off the river. Horses, stock cattle, and sheep are raised in very considerable quantities, but of course they are driven to market and do not affect the water route.

Considerable developments are being made, and mineral lands are much sought after and readily bought and sold.

The Cripple Creek Railroad Company is putting up a new iron furnace on Reed Island Creek, also one at Foster's Falls.

Ivanhoe Furnace is soon to be changed from charcoal to coke, and so are several others further up the creek.

A survey of the portion of the river under consideration was made under your direction in September, 1878, a report of which will be found in the Report of the Chief of Engineers U. S. Army, for 1879, Appendix F, commencing at page 539, to which you are respectfully referred, for it gives in detail much information with regard to the resources of this country.

From the above showing it will be seen that in timber and minerals the country abounds. The question now arises, can they be carried down the river through the channel, as it is now being made? The sum of $10,000 has already been expended, producing a channel 20 feet wide and 2 feet deep, at ordinary summer water, to within 400 feet of Fowler's Ferry, 6¼ miles above the lead mines and 3.65 miles above Ivanhoe Furnace. The distance is given from the furnace, for it in the future must be the initial point of this work, if the plan of making the improvement tributary to the railroads running along the banks of the river and crossing the same is to be adhered to.

The grades being heavy and obstructions numerous, it was decided to make the channel only 20 feet wide, in order that the small appropriations might be made as useful as possible. This width, however, does not permit walls being built along which the boatmen could move and pull their boats. The current and natural channel, for the same reason, had to be followed, which makes the new channel very much curved in many places and somewhat difficult to navigate.

With an appropriation of $5,000 the channel as now made to Foster's Ferry, 6¼ miles, could be widened to 40 feet and the walls referred to be built with the extra material, and by an increased width the velocity would be diminished, thus enabling boats to go up as well as down, which is now very difficult and rarely attempted.

This width of 40 feet could be carried up the stream at a cost about double that of the 20-foot channel. The boats referred to are 60 feet long, 7 feet wide, and 3 feet deep, carrying about 6 tons.

With regard to rafting timber, the channel can be left as it now is, with the exception of straightening two points in Rogers's and cutting off two bends in Wilkinson's shoals; in fact a contract has been made to raft heavy oak timber down this channel in its incomplete state this summer. These timbers are for bridges and trestles on the Cripple Creek Railroad.

It is thought that the $10,000 now under consideration will make such a channel as far as Grayson Sulphur Springs, 6.8 miles above Ivanhoe Furnace, and into the timber region; anyhow it will make it as far as the New River Mineral Company's ferry at Crooked Creek, 5¾ miles above the initial point, where timber can be had, but not in such quantities as higher up the river.

It may as well be mentioned here that the heavy work in this section begins at Rogers' Shoals, 1.4 miles above Ivanhoe
3611–C Furnace, and continues for nearly 14 miles through the mountains (river hills); thence to the mouth of Wilson Creek, 43 miles. With the exception of two falls, 10 miles below the stream mentioned, the stream can be easily and cheaply improved.

A map (scale 6 miles to the inch) of New River and its tributaries, from its sources in North Carolina, through Virginia, to the mouth of the Greenbrier, in West Virginia, showing the railroad following and crossing the same, accompanies this.[13]

A project for the expenditure of the $10,000 last appropriated to continue the improvement for the purpose of making a channel for rafting is herewith appended.

Respectfully submitted.

WM. PROCTOR SMITH.

Col. WILLIAM P. CRAIGHILL,
*U. S. Engineers.*

PROJECT FOR THE EXPENDITURE OF $10,000 APPROPRIATED AUGUST 5, 1886, FOR CONTINUING THE IMPROVEMENT OF NEW RIVER, VIRGINIA, BETWEEN THE MOUTH OF WILSON AND THE LEAD MINES IN WYTHE COUNTY, VIRGINIA

| | |
|---|---|
| 4 canoes, at $20 | $80 |
| 5 rock boats, at $25 | 125 |
| 1 skiff, at $25 | 25 |
| Tools, tents, lumber, rope, chain, and camp outfit | 450 |
| | 680 |

[13] Map omitted.—W. P. C.

ROGERS' LEDGES

(1.4 miles above Ivanhoe Furnace)

To straighten channel and widen curve at upper ledge ..... $300

WILKINSON'S SHOALS AD LEDGES

(2.1 miles above Ivanhoe Furnace)

To widen and smooth channel at forge and to widen at curve at Fish Trap ..... 400
To finish channel at upper end, not completed in 1885 ..... 300

EARLY'S SHOALS

(4.4 miles above Ivanhoe Furnace)

10 ledges, flat slate, 25 to 35 feet wide each; almost continuous cutting; river broad; length about 300 feet; fall, 2.7 feet ..... 1,800

ALLEY'S LEDGE

(4.9 miles above Ivanhoe Furnace)

6 scattering ledges, about 25 feet wide each; fall, 6.45 feet ..... 450

GULP SHOALS

(5.6 miles above Ivanhoe Furnace)

Between one-half and three-fourths mile long; lower part very rough; runs between hills on either side; water swift; consists of 20 ledges slate; sometimes as many as 3 in a group; fall 12.54 feet—10 feet in less than one-half the distance ..... 4,000

CROOKED CREEK SHOALS

(5¾ miles above Ivanhoe Furnace)

5 ledges, close together; fall, 21½ feet ..... 375

3611-D

GRAYSON SPRING'S LEDGES

(6.8 miles above Ivanhoe Furnace)

Five-eighths mile in length; fall, 8 feet; 12 to 16 ledges, 10 to 25 feet wide each ..... $1,665

10,000

Rather a small amount for the last shoal, but some money may be saved from the others. Early's Shoal has been estimated at much less, previously, but in fact it is with great difficulty one can get even a good approximate with water tolerably high and not clear. Rogers' and Wilkinson's ledges are not described, as

they have been worked through and described fully in reports and projects.

In view of the difficulty in making accurate estimates as to quantity and quality of the material to be removed on which to ask bids for contracts, it is respectfully recommended that the work can be better and more economically carried on by procuring the labor and purchasing the materials in the open market.

3612 *Defendant's exhibit No. 561*

Report of the Chief of Engineers for the year 1888, pages 225, 226, 1760, 1761. (Original Exhibit.)

*Defendant's exhibit No. 562*

Report of the Chief of Engineers for the year 1889, pages 261, 262, 1961, and 1962. (Original Exhibit.)

*Defendant's exhibit No. 563*

Report of the Chief of Engineers for the year 1890, pages 235, 236, 2249, 2250, 2251. (Original Exhibit.)

3613 *Defendant's exhibit No. 564*

Report of Brigadier General Casey, Chief of Engineers, United States Army, to the Secretary of War, dated November 16, 1894, to which is attached a third endorsement by Col. Craighill's underlying report, and also a second endorsement.

3614 *Defendant's exhibit 564*

Filed: Office of the Secretary, War Department, October 8, 1894. 1373—3. Office of Chief of Engineers, War Department, October 9, 1894. 8366—3. W. H. Bolling, Attorney.

Petitions on behalf of Pulaski Iron Co. & other iron & mineral companies, that New River, Va. be exempted from operations of R. & H. Act, & that permission be granted them & others engaged in similar operations to flow water from their washers into New River & its tributaries & that Sec'y of War hear testimony & grant them full relief from operation of act above referred to.

* * * * * * *

(2d indorsement)

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
*Oct. 9, 1894.*

Respectfully referred to Col. Wm. P. Craighill, Corps of Engineers, for report.
To be returned.
By command of Brig. Gen. Casey:

H. M. ADAMS,
*Major, Corps of Engineers.*

8366—3. 8366 & inclos. 1 & 2 accomp'g.

(3d indorsement)

U. S. ENGINEER OFFICE,
9 PLEASANT ST.,
*Baltimore, Md., November 14, 1894.*

Respectfully returned to the Chief of Engineers. I was unable to visit New River owing to my detail on the Board to
3615 select a route for a canal between Chesapeake & Delaware Bays, and other duties which prevented an absence from Baltimore of sufficient length for a personal examination. A reliable assistant was sent who has made a report which is herewith. In addition I have had correspondence with other parties and send herewith a letter of October 29, 1894 from Gov. MacCorkle of West Virginia in which he encloses a report of certain experts who have examined into this matter; also a letter of Nov. 1, 1894 from Atty. H. E. Davis.

The law which is brought forward as applicable to this case is Sect. 6 of the River and Harbor act of 1894, in which the following is found: "That it shall not be lawful to place, discharge, or deposit, by any process or in any manner, ballast, refuse, dirt, ashes, cinders, mud, sand, dredgings, sludge, acid, or any other matter of any kind other than that flowing from streets, sewers, and passing therefrom in a liquid state, in the waters of any harbor or river of the United States, for the improvement of which money has been appropriated by Congress, elsewhere than within the limits defined and permitted by the Secretary of War."

Some of the language is peculiar and seems to be specially applicable to New River, which is a river "for the improvement of which money has been appropriated by Congress." In a previous endorsement (3d, Sept. 29, 1894, 8366, herewith) it was stated

that "the last appropriation for 'this river was made in 1886 and the last work on it by the U. S. was in 1889. Since the development of the railroads in that section there has been no need for work on the river by the U. S.'" And it may be added that there is no navigation at present on the river except by a few push-boats, and there is not likely to be a commerce on the river for many years nor until the population and trade should increase to such an extent as to justify the expense of introducing a system of locks and dams. It may therefore be stated that the discharge of ore-washings into New River should not be considered as endangering navigation. As the New River with the Gauley form the Great Kanawha on which the U. S. has expended a large sum of money with important results for great commercial interests, it was deemed necessary to ascertain whether the
3616 discharge of ore-washings in the New River near its head would work injury to the navigation of the Great Kanawha. My opinion is that no such injury need be apprehended.

If, however, it should be deemed necessary to prevent in whole or in part this discharge into the river, I can suggest no other remedy than the construction of settling basins & dams and a sufficient definition of their "limits" would be at any place near each plant which should be preferred by the owner or operator, with compliance with the conditions of consistency of the material prescribed by Congress.

(Signed) WM. P. CRAIGHILL,
*Colonel, Corps of Engineers, U. S. A.*

4 Enclosures.

(4th)

Nov. 16, 1894.

Respectfully returned to the Secretary of War.

Certain iron and furnace companies in the State of West Virginia petition the Secretary of War to exempt New River, in that State, from the operation of Section 6 of the Act of Congress of August 17, 1894, and to grant them permission to flow the waters from their ore washers into New River and its tributaries.

It appears that there are about eighteen ore washers in New River and its tributaries and that they throw a volume of over two million gallons of mud laden water into the river, each day, in a distance of 30 miles. It is alleged by the Governor of West Virginia, and others, that this flowing of ore washings into the river pollutes the water and renders it unfit for domestic purposes, destroys the character of the scenery, and destroys both fish and game.

These papers have been referred to Col. W. P. Craighill, Corps of Engineers, to whose report, in third indorsement hereon, attention is respectfully invited. This officer states that the discharge of ore washings into the New River endangers neither the navigation of that river, on which there is no commerce,
3617 nor the navigation of the Great Kanawha River which is formed by the junction of the New and Gauley rivers.

As navigation is not interfered with, and no complaint is made of injury to navigation interests, it would seem that the Secretary of War has no authority to restrain the flowage of these washings into the river, for the jurisdiction of the War Department over the river attaches solely for the preservation and protection of navigation and that is the object of Section 6 of the Act of August 17, 1894. Again it would appear that he has no authority to license or permit the doing of the thing which is claimed to be a local damage to the country and an injury to the people.

I recommend therefore that this petition be denied and that both parties to the controversy be informed that the War Department will take no action in the matter unless it should appear in the future that navigation was injured or was threatened with injury.

(Signed) JNO. LINCOLN CASEY,
*Brig. Gen., Chief of Engineers.*

8366-3. 8366 & inclos. 1, 2, 4, 5, 6. 11—14 accomp'g.
Rec'd. Office Chief of Engineers, Nov. 21, 1894.
Rec'd. Back, War Dep't. Nov. 16, 1894.

3618 *Defendant's exhibit 565*

58th Congress, 2d Session. House of Representatives. Document No. 176.

NEW RIVER, WEST VIRGINIA

Letter from the Secretary of War, transmitting, with a letter from the Chief of Engineers, report of examination of New River, West Virginia.

December 18, 1903.—Referred to the Committee on Rivers and Harbors and ordered to be printed.

WAR DEPARTMENT,
*Washington, December 16, 1903.*

SIR: I have the honor to transmit herewith a letter from the Chief of Engineers, United States Army, dated December 1, instant, together with copy of a report from Capt. W. E. Craig-

hill, Corps of Engineers, dated February 4, 1903, of a preliminary examination of New River, West Virginia, made by him in compliance with the provisions of the river and harbor act of June 13, 1902.

Very respectfully,

ELIHU ROOT,
*Secretary of War.*

The SPEAKER OF THE HOUSE OF REPRESENTATIVES.

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
*Washington, December 1, 1903.*

SIR: I have the honor to submit herewith report, dated February 4, 1903, by Capt. W. E. Craighill, Corps of Engineers, on preliminary examination of New River at its confluence
3619 with the Greenbrier River, West Virginia, ordered by the river and harbor act of June 13, 1902. Captain Craighill expresses the opinion, which is concurred in by the division engineer, Col. G. J. Lydecker, Corps of Engineers, that the locality is not worthy of improvement by the United States.

The object of this examination and the effect on the water front at Avis, or Upper Hinton, of improvements heretofore made in this stream by the General Government are fully stated in a report, dated May 1, 1903, by the Board of Engineers for Rivers and Harbors, which has reviewed this report under the provisions of sections 3 and 14 of the above-mentioned act. The locality has been personally inspected by a representative of the Board, and in view of the information before it the Board concludes that it is not advisable for the United States to undertake the improvement of New River at its confluence with the Greenbrier.

I concur in this opinion.

Very respectfully, your obedient servant,

G. L. GILLESPIE,
*Brig. Gen., Chief of Engineers, U. S. Army.*

Hon. ELIHU ROOT,
*Secretary of War.*

PRELIMINARY EXAMINATION OF NEW RIVER, WEST VIRGINIA, AT ITS CONFLUENCE WITH THE GREENBRIER RIVER

UNITED STATES ENGINEER OFFICE,
*Wheeling, W. Va., February 4, 1903.*

GENERAL: In compliance with instructions contained in your letter dated June 23, 1902, I have the honor to submit the follow-

ng report upon the examination of New River at its confluence with the Greenbrier River.

From correspondence with those interested in having this examination made it was learned that the object of it was to determine whether or not the improvements made by the United States in the New River at and near the mouth of the Greenbrier in the year 1878 (see Annual Report of the Chief of Engineers for 1879, Part I, p. 536) have operated to cause the bank of the New River to scour, injuring the town of Avis.

Avis (formerly known as Upper Hinton) is immediately above Hinton, W. Va., on the right bank of the New River and
3620 a short distance below the mouth of the Greenbrier, which comes into the New River on the side upon which Avis is built.

The work of improvement by the United States in the New River consisted in blasting channels out of the solid rock bottom above and below the mouth of the Greenbrier. The rock excavated was piled on both sides of the channels, the object being to form chutes for flatboat navigation, the chutes being about 50 feet wide and intended to give a depth of 18 inches at low water.

The Greenbrier enters the New River at an acute angle, pointing downstream, and just below the junction there are three low islands, separated from each other and from the point between the two rivers by narrow channels.

Both rivers are mountain torrents, with very steep, rocky beds. The Greenbrier River rises in the eastern part of West Virginia, while the New River rises in North Carolina and flows thence northward through Virginia into West Virginia. As the two rivers have their sources so widely separated a considerable freshet may occur in one while the other is low. When a rise comes out of New River and none out of the Greenbrier, the New River flood water passes between the islands below the confluence, and when it reaches a height of about 10 feet passes over the islands. The resultant current strikes the shore in front of Avis, and in the past has caused considerable damage. It is claimed by some of the citizens of the town that the direction of the channels cut by the United States tends to throw more of the current against the Avis water front than would otherwise naturally be the case. In the report of the improvement of the New River above referred to the following statement is made, indicating that the erosion of the bank in front of Avis was going on at the time of the commencement of the work of improvement:

"Arrangements for beginning work, the procuring of tools, boats, blasting materials, etc., were made at once, and a force of hands got to work on the shoals between the landing and the foot of Greenbrier shoal on September 7.

"Operations were a good deal delayed by the unprecedented rise in the river, which on September 13 reached 20.2 feet above low water at Hinton. At the mouth of Blue Stone River, 5 miles above, its highest point was 23.7 feet above low water. This was from 5 to 6 feet higher than ever known before. It did 3621 much damage in the valley. At Upper or Old Hinton, sixteen buildings, several of them good frame houses, were carried away. The sawmill of Mills & Co., the only one then in operation in the place, was also seriously damaged."

In view of the statements contained in the preceding quotation and from a personal examination of the ground I am satisfied that the causes of the damage to the town of Avis were in operation before the commencement of the Government work in the New River, and that these works are not responsible for its continuance. As a rule rivers which are subject to freshets are liable to erode their banks after the country is settled and the banks cleared of their trees and underbrush. At many points on the Kanawha, of which the New River is one of the headwaters, this action has taken place and is now going on.

In my opinion the locality is not worthy of improvement by the United States.

Very respectfully,

W. E. CRAIGHILL,
*Captain, Corps of Engineers.*

Brig. Gen. G. L. GILLESPIE,
*Chief of Engineers, U. S. A.*
(Through the Division Engineer.)

(First indorsement)

ENGINEER OFFICE, U. S. ARMY, CENTRAL DIVISION,
*Cincinnati, Ohio, February 5, 1903.*

Respectfully forwarded to the Chief of Engineers, United States Army, concurring in the views and opinion expressed within.

G. J. LYDECKER,
*Colonel, Corps of Engineers,*
*Division Engineer, Central Division.*

(Second indorsement)

OFFICE CHIEF OF ENGINEERS, U. S. ARMY,
*February 17, 1903.*

Respectfully referred to the Board of Engineers for Rivers and Harbors constituted by Special Orders, No. 24, Headquarters, Corps of Engineers, series of 1902, for consideration and recommendation, as required by section 3 of the act of June 13, 1902.

Previous papers on the subject on file in this office are herewith.

By command of Brig. Gen. Gillespie:

A. MACKENZIE,
*Colonel, Corps of Engineers.*

3622 (Third indorsement)

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
*Washington, D. C., May 1, 1903*

Respectfully returned to the Chief of Engineers, United States Army.

The Board of Engineers for Rivers and Harbors has considered the within report of the district officer upon a preliminary examination of "New River (West Virginia, at its confluence with the Greenbrier River," the indorsement of the division engineer thereon, and other data available, including detailed maps showing the extent and character of improvements heretofore made in the vicinity by the United States. On April 7, 1903, the locality was inspected and further reported upon by the assistant engineer of the Board.

It appears that the object of the preliminary examination is to determine whether or not certain works of improvement made by the United States in New River in the years 1878–79 have operated to cause the bank of New River to erode in front of the town of Avis, or Upper Hinton. The works referred to consist of a channel blasted through a rocky reef from a point 6,400 feet above Avis to a point 10,000 feet above that town and of deposits of spoil along the sides of said channel. At the time of the inspection of the locality the river was at a 3-foot stage, somewhat below a mid stage, yet even at the lower water the works complained of were not even visible, and produced no apparent effect on the current.

The absence of erosive effects upon the islands below the reef and above Avis, against which the water would impinge if the Government work produced any marked diversion of the current, the remoteness of the Government work from the town of

Avis, and the slight effect which could be produced upon the banks by work of such character and limited extent convince the Board that no connection can be traced between the Government work and bank erosion at Avis.

The Board believes that it is not desirable that the United States should undertake the further improvement of "New River at its confluence with the Greenbrier River," West Virginia.

For the Board:

H. F. HODGES,
*Major, Corps of Engineers,*
*Senior Member Present.*

3623 *Defendant's exhibit 566*

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
*Washington, May 19, 1916.*

Refer to File No. 8366.

Memorandum for the Secretary of War

Subject: Pollution of the waters of New River and its effluent, the Kanawha River, by the flowing of ore washings from the mines and furnaces located on the former river and its tributaries

1. This matter has been under consideration by the War Department, from time to time, since 1894, and has been the subject of much investigation and study. The original allegation was that the flowage of ore washings into New River polluted the water, rendered it unfit for domestic uses, defaced the scenery, destroyed both fish and game, and thereby inflicted serious injury upon the people of the State. For these reasons the State of West Virginia asked that the Secretary of War invoke the power conferred by Federal laws, enacted for the preservation and protection of navigation, to prohibit the operations of the iron and furnace companies in this regard. These companies, on the other hand, asked to have New River exempted from the operations of the aforesaid laws, and to have permission granted them to flow their ore washings into these waterways. After thorough consideration of the facts, and arguments presented by the opposing interests, and examination of conditions on the river, the conclusion was reached that navigation was neither injured nor endangered by the discharge of ore washings, and the Secretary of War decided to take no action whatever in the matter.

2. Subsequently; the iron and furnace companies presented a petition to the Department, asking that a permit be granted to cover their operations, it being alleged that the U. S. District Attorney was about to institute proceedings against them,
3624 and a permit was therefore necessary to forestall such proceedings. In reporting on this petition the Chief of Engineers expressed adherence to his former conclusion, and added:

"The interests of navigation are not involved in this matter; the controversy is one purely of local concern, and it is believed that the War Department should take no action that would embarrass any of the citizens of West Virginia in taking steps to abate what they consider a nuisance, or in making legal resistance to what they conceive to be an aggression upon their rights."

The Secretary of War concurred in this view, and the case was again dismissed.

3. About a year later the companies, through their representatives in Congress, again petitioned for a permit. The Chief of Engineers against opposed the proposition on the aforesaid grounds that the case did not come within the purview of the Federal laws, but was one for local adjudication; but, in an opinion rendered February 12, 1896, by the Attorney General, to whom the question was submitted, it was held that the Secretary of War should act on the petition, but should be governed only by considerations affecting the present and prospective navigation of the rivers. Accordingly the Secretary of War, under date of February 26, 1896, addressed a letter to Messrs. James A. Walker and Claude Swanson, representatives in Congress from the State of Virginia, in which after naming the petitioners, the iron and furnace companies, 24 in all, he said:

"I have the honor to inform you that the limit within which ore washings from those mines may be deposited shall be that portion of New River near said mines, respectively; it being distinctly understood that this permission is revocable and void if at any time in the future the amount of ore washings be so great as to be hurtful to the interests of navigation."

4. This was regarded as a permit under which the companies continued the practice of flowing their ore washings into the aforesaid streams. Efforts were made by the State of West Virginia at various times to have this action revoked, and in
3625 1899, Senator Elkins brought the matter to the attention of the Department presenting a copy of the original complaint and petition of 1894. In submitting the case at that time to the Secretary of War for decision, the Chief of Engineers,

after reciting the essential features of the complaint (set forth in paragraph one above) stated his position as follows:

"These are important matters to the people of West Virginia, and the injury inflicted is doubtless of a serious nature; but it is submitted that the General Government can afford no relief and provide no remedy in the premises. The control of Congress over waterways is conferred by the commerce clause of the Constitution of the United States, and is to be exercised for the preservation and protection of navigation and the regulation of commerce only. The existing laws were enacted, and are to be executed for this purpose only.

"Congress has passed no statute to protect the fish or the scenery of New River, or the purity of its water, and unquestionably such a statute if passed would be invalid. These are subjects which belong to the States alone, and as Congress could not directly legislate concerning them, it follows that it could not reach them indirectly through the powers committed to the Secretary of War in the existing laws.

"As these matters bear no relation to navigation, and no injury to navigation interests is to be apprehended, I am convinced that the only action the Secretary of War can take to relieve the situation, would be to revoke the permit heretofore given to the iron and furnace companies to deposit ore washings in the river near their mines. I think this should be done, and then the matter can be left for local adjustment without being complicated by War Department action.

"The parties aggrieved can then apply to the legislatures of the States for the passage of the necessary laws to effect an abatement of the nuisance complained of, if there are no such laws now in existence; if the necessary laws are already enacted, then they can resort to the local courts for a redress of their grievances."

3626 5. By letter of September 11, 1899, the Secretary of War (Mr. Root) advised Senator Elkins that as the case "involved no interference with navigation, and no complaint is made of injury to navigation interests, it would seem that the Secretary of War can afford no relief in the premises, the matter being one within the control of the State authorities."

6. Ten years later, or in 1909, the matter was again investigated, it being alleged that navigation was injured, by reason of deposits from the washings, and to the chemical action of the water on the boilers and other apparatus of steamboats, but, on investigation, it was again decided that no injurious effect on navigation was apparent.

7. Again in 1910 a petition was filed by the State of West Virginia renewing the original controversy, the essence of the complaint being the same, with the added allegation:

(a) That the ore washings caused solid deposits in Kanawha River, to which New River is tributary, thus decreasing navigable depths of the channels;

(b) That the washings increase the tendency of all the iron and steel, employed in the locks and dams, to rust, thereby decreasing their period of usefulness; and that, by adding to the turbidity of the streams, the washings interfere with work of improvement carried on under water, such as lock excavation, removal of logs and stumps, and other operations requiring the service of divers;

(c) That the washings produce conditions destructive to the boilers, machinery and apparatus of steamboats, and other vessels, employed in navigation; and also render the water unfit for the usual purposes to which it is applied on such boats thus adding to the dangerous discomforts, and inconveniences of navigation.

8. This petition and complaint took the usual course. The district engineer officer gave the allegations exhaustive consideration, held a public hearing, accorded both interests the fullest opportunity to present their respective sides of the controversy and submitted a report thereon in November 1910, which
3627 covered the various arguments and contentions presented by the parties. The report was then examined by the attorneys to both sides of the controversy and they were afforded an opportunity to submit comment and argument upon its various features. Summarized, the specific request of the petitioners was:

(a) That the aforesaid permit (so-called) of February 26, 1896, be revoked;

(b) That the mining companies be required to construct and use settling basins in connection with their operations, or some other device that would accomplish the same purpose.

9. In presenting the matter to the Secretary of War, July 13, 1911, the Chief of Engineers stated:

"While this action is desired ostensibly in the interest of navigation on the Kanawha River, it is probable that the real basis of the request is the desire to preserve for the people of the State the use and enjoyment of the waters and the scenery of New River.

"I have given all the facts presented careful examination and study, and am unable to find any good reason for dissenting from the position taken by my predecessors as hereinbefore set

forth. At the time the permit was granted there was no apparent interference with navigation by the ore washings, and the only effect of the permit was to save the companies from any attempted prosecution in the Federal courts, and that is the only office it serves now. It did not then, nor does it now, authorize any infringement of state laws, or affect in any way the power of the State and local authorities to regulate and control the operations of the companies in matters of local concern.

"There has been no useful navigation on New River at any time, and none is possible under existing natural conditions, nor without the expenditure of vast and prohibitive sums in improvement work. While the discharge of ore washings in New River may produce conditions in Kanawha River injurious and obstructive to navigation, in the various ways alleged by the petitioners, it is probable that in most instances the effect is too remote, and too much complicated with other causes to warrant the action desired by the petitioners; and it is extremely doubtful that such action, if taken by the Department, would be sustained by the courts.

3628

"That the continued operations of the mining companies have, however, now begun to injuriously affect to some extent navigable conditions on Kanawha River, is believed to be susceptible of proof. The District engineer states that around the forebays of the Government locks, the amount of dredging necessary has been increased in recent years, which increase is properly traceable to the New River ore washings; and that the deposit of mud on the service bridge trestles, causing them to rust and deteriorate, is much more common at the present time than in the earlier years of the improvement, this mud deposit being likewise attributable to the ore washings.

"In view of these results of the companies operations, results which are tangible and capable of being demonstrated, and which are directly harmful to the public interest committed to the care of the War Department, I am of the opinion that, as the Department may not be justified in the immediate and arbitrary revocation of the permit and the consequent subjection of the companies to prosecution in the Federal Courts, it would be proper for the Department to now require the added installation, in connection with these operations, of settling basins or other suitable devices for minimizing their objectionable and injurious effects. I recommend therefore as a condition precedent to any continuance in force of the existing permit, all the mine owners whose operations will extend over a longer period than one year and are covered by the said permit, be required to install the foregoing devices without delay. I further recommend that a similar requirement be made regarding those mine owners, if any, whose

operations are not covered by the permit, in lieu of the institution of proceedings against them for violating the provisions of the Federal statute."

3629 10. On November 20, 1911, the Secretary of War approved the recommendation of the Chief of Engineers and on December 2, 1911, the various corporations and companies discharging ore washings into New River were given notice that such deposits would only be allowed within or behind settling basins, or their equivalents, outside of the river, so arranged that their over-flow reaching the river shall be free from solid matter of any kind, such basins to be commenced within six months and be completed within 12 months from date of the said notice.

11. July 16, 1912, the Virginia Iron, Coal and Coke Co., stated that they were erecting settling basins for their Sanders and Cedar Run mines but asked for an extension of time in which to exhaust certain others (Tasker, Rustin, Reed Island and Rich Hill mines). An extension of time to December 2, 1913, was recommended by the district officer and the Chief of Engineers and granted by the Secretary of War.

12. In a report of November 10, 1913, the District Engineer Officer stated that the last personal examination of iron ore washings in the New River district was made about June 1, 1913, which showed that all companies except the Virginia Iron, Coal & Coke Co., had ceased depositing their washings in the New River without first being settled; that they would probably ask for another extension of time; and that in view of the probable short time that the mines would be worked, for which it would be unprofitable to build settling basins, he intended to recommend that an extension of time be granted.

13. On December 3, 1913, the Virginia Iron, Coal and Coke Company, requested an extension of time within which to mine out the ore remaining in three of its properties (Tasker, Rustin and Reed Island mines). A personal examination of conditions was made by the District Engineer Officer on January 5, and 6, 1914, and an exhaustive report on conditions submitted February 14, 1914. He expressed the belief, giving his reasons therefor, that the chief causes of the unsatisfactory conditions of the New and Kanawha rivers were erosion from soil and factory and industrial wastes. He stated that the mines depositing washings in the river had been reduced from 17 to 3 and calculated

3630 that the decrease in deposits, turbidity, etc., caused by the ore washings should have been between 80 and 90 percent of what they were previous to 1910 whereas the average improved condition was about 50 per cent, and that for a period (May to December, 1913) of no high waters. A further extension of time to June 1915 was recommended by the district officer, but the

Chief of Engineers, in submitting the matter to the Secretary of War recommended that an extension to June 30, 1914, and no longer be granted. This recommendation was approved by the Acting Secretary of War May 23, 1914, and the company so notified on May 29, 1914.

14. On June 9, 1914, the Virginia Iron, Coal & Coke Co. petitioned for an extension of time until June 30, 1915, in which to exhaust their three mines (Tasker, Rustin and Reed Island) before the order of the Secretary of War, regarding the erection of settling basins, should be made applicable to them. The mines are about 250 miles above navigation. The Chief of Engineers in a memorandum of July 2, 1914, to the Secretary of War recommended that no further extension of time be granted, on the basis that for each ton of ore mined ten tons of solid matter were being discharged into a tributary of navigable water. He stated that this material had moved downward and had been deposited at various places, upon bars and in shallows, perhaps clear down to the mouth of the Mississippi, and that in his opinion navigation has, or may have been impeded or obstructed thereby. This recommendation was approved July 6, 1914, by the Assistant Secretary of War, then Acting Secretary, but the Secretary, on July 16, 1914, reversed the ruling and extended the time to July 1, 1915, saying to the Company that "this is the final extension that will be granted, and you must not expect favorable consideration upon any application for any further continuance or extension."

15. On July 10, 1915, after the time had expired, the district officer inspected the mines of the company and found active operations being carried on at the Cedar Run and Sanders mines, for which settling basins had been constructed, and steps were being taken to place the Tasker mine in active operation, for which a settling basin was being provided by the construction of an earthen dam or embankment to retain the material.

3631 16. Although all the mines in operation have been provided with settling basins, complaints against the pollution of the rivers are still being received. On March 14, 1916, a letter was received from Hon. Adam B. Littlepage, M. C. in which a statement is made in regard to past action with reference to this pollution and asking that the Attorney General be called upon to prosecute and to enforce the revocation of the permits allowing the discharge of these iron ore washings in the rivers.

17. On April 19, 1916, the district officer (Major T. H. Jackson, Corps of Engineers) made another inspection of the mines to determine the conditions, not only at the basins, but at the washers and in the streams into which the basins are discharged, with a view of learning something of the operations since the time

f the last inspection, July 10, 1915. As a result of the inspec-
ion he reports that the washers are being operated in accordance
vith the War Department instructions and the operators indi-
ated a willingness to do anything within reason that will meet
ot only the present but any additional requirements. He con-
idered the depth of water in the vicinity of the discharge outlets
t the Cedar Run basin insufficient and gave instructions to have
t increased. He also reported that no complaints had been
nade to his office by river interests that navigation was being
nterfered with or injured by this or other industries placing
naterials in the Kanawha River or its tributaries; that the op-
rations as at present conducted cannot be said to have any
njurious effect on navigation; and he recommends that no further
ction be taken in the matter and the complainants be so informed.

18. The output of spoil from the Tasker and Cedar Run mines, based on active operations, is estimated by the district officer as about 275,000 cubic yards per year, and he considers, assuming reasonable care in the control of the settling basins, that one per cent of this, or 2,750 cubic yards, is a high estimate of the amount of the material which escapes from the basins. Such material as escapes from the basins is so fine that he considers it doubtful
if more than a small portion of it will be deposited in the
3632 river at any point, and that if it is deposited in the river
during low water stages at points where the current is slack, it would be picked up again during flood stages and carried out of the river. He states that the material in the navigable portion of the Kanawha River is especially fine, so fine that sand and gravel for building purposes are in general obtained from the Ohio River, indicating that little heavy material is brought down to the navigable waters of the Kanawha River.

19. All of the mines now in operation have settling basins. It is not believed that the United States should attempt to force these operators to so control their settling basins that only clear water should pass into the river. The turning loose in the Kanawha River, at a point over 180 miles above the navigable portion, of 5,000 or even 50,000 cubic yards of fine material per year cannot possibly produce any appreciable injury to navigation.

20. I recommend therefore that Hon. Adam B. Littlepage, and also Hon. Carter Glass, be informed that all of the ore mines in operation on the New and Kanawha rivers have installed settling basins for taking care of their ore washings; that the United States would not be justified in attempting to force the operators to so control their settling basins that only clear water should pass into the river; that the amount of material which escapes from the basins is so fine and so small in quantity that it cannot

possibly produce any appreciable injury to navigation; and that the War Department will take no further action in regard to the matter unless really satisfactory evidence is produced, that navigation is injured or threatened with injury as a result of the deposit of this material in the river. They should also be informed that on April 19, 1916, an inspection of the impounding reservoirs of the Tasker and Cedar Run mines of the Virginia Iron, Coal and Coke Company was made; that the depth of water in the vicinity of the discharge outlets of the Cedar Run mine was considered insufficient and instructions were given to increase the same, and that the conditions at all points indicate that the operators are trying to comply with the instructions of the Department, but that it is the intention of the District Officer
3633 to require that in future a prescribed minimum depth of water be maintained near the outlets of basins and that a monthly report be submitted giving such data as will permit him to keep a check on the conditions of the discharge and direct the raising of the dams and outlets from time to time.

(Signed) W. W. BLACK,
*Chief of Engineers, U. S. Army.*

11 inclos. viz:

83 66/193 Letter of Hon. Carter Glass, Dec. 10, 1915;
" 195 Copy of W. D. letter of Jan. 3, 1916 to Mr. Glass;
" 196 Letter of Hon. Carter Glass, Jan. 7, 1916;
" 197 Letter of Hon. Adam B. Littlepage, Mar. 14, 1916;
" 198 Copy of W. D. letter of Mar. 17, 1916 to Mr. Littlepage;
" 199–204 subsequent correspondence and reports.

8366/206. (2nd Ind.) wsh.

Office C. of E., May 23, 1916—To The District Engr. Officer, Wheeling, W. Va.
To note.

C. K.

2 inclos. viz:

8366/207 Copy of W. D. letter May 22 to Hon. Adam B. Littlepage;
" 208 Copy of W. D. letter May 22 to Hon. Carter Glass.

280/72. (3d Ind.) SAA–RIL

J. S. Engr. Office, Wheeling, W. Va., May 27, 1916—To the
ief of Engrs.
. Noted.

T. H. S.

2 inclosures—
Copies of W. D. letters to
Hon. Adam B. Littlepage & Hon. Carter Glass.
Tues. 207–208 accpg.

34 *Defendant's exhibit No. 567*

Page 1284 of the Annual Reports of the Chief of Engineers
the War Department, year 1917. (Original Exhibit.)

34-A *Defendant's exhibit No. 568*

FEDERAL POWER COMMISSION,
*Washington, July 1, 1925.*

E.
Decla. of Int.—Va.
New River Development Co.

r. C. BASCOM SLEMP,
Care, GOOD, CHILDS, BOBB & WESTCOTT,
*815 Fifteenth Street, Washington, D. C.*

DEAR SIR: Receipt is acknowledged of the declaration of in-
ntion filed by the New River Development Company of New
ork to construct a dam in the New River near Radford,
irginia.

From a study of the data at hand it appears that the United
tates has expended funds for the improvement of the New
iver and, therefore, it is "navigable waters" within the defini-
on of the Federal Water Power Act. Because of this fact it
ppears that the proposed project must necessarily come within
he jurisdiction of the Commission. However, in order to com-
ly with the provisions of the Act the declaration is being for-
arded to the War Department for investigation and recom-
endation as to such jurisdiction.

In view of the practical certainty that a decision will be made
lacing the proposed development under Federal control, it will
xpedite matters if you will now prepare and forward to the
ommission an application for preliminary permit or license.

Such application can be withdrawn if it should later develop that a Federal license is not required.

Very truly yours,

(Signed) O. C. MERRILL,
*Executive Secretary.*

3634–B *Defendant's exhibit No. 569*

Letter dated July 3, 1925, addressed to Honorable O. C. Merrill, Exec. Secy., F. P. Co., Washington, D. C. and signed by C. B. Slemp. (Original Exhibit.)

3634–C *Defendant's exhibit No. 570*

OCTOBER 24, 1925.

Attention Major Edgerton, Chief Engineer

The FEDERAL POWER COMMISSION, *Washington, D. C.*

DEAR SIRS: We beg to enclose our letter of this date to Major-General Harry Taylor, Chief of Engineers, in regard to request for modification of his report dated August 20, 1925 in the above matter, which we should appreciate your forwarding to General Taylor if, as we assume, that is the proper procedure. An additional copy of our letter, together with copies of the documents attached to the original letter, except those which are already on file with you, is enclosed for your files.

However, if it should have been decided that the recommendation to be submitted to the Commission in regard to New River Development Company's Declaration of Intention should be that the Commission does not find that the interests of interstate or foreign commerce would be affected, i. e., substantially affected, we should, of course, not desire to request a reconsideration by the Chief of Engineers of his report of August 20, 1925 and in such case would thank you to advise us and return to us our letter addressed to the Chief of Engineers without submitting it to him.

Respectfully,

CURTIS, MALLET-PREVOST, COLT & MOSLE.

CMM–12.
Encl.

3634-D *Defendant's exhibit No. 571*

OCTOBER 24, 1925.

By Courtesy of Federal Power Commission.

Re Report of Chief of Engineers dated August 20, 1925 upon Declaration of Intention by New River Development Company to construct a Power Development in New River near Radford, Pulaski, Virginia

Major-General HARRY TAYLOR,
*Chief of Engineers,*
*War Department, Washington, D. C.*

DEAR SIRS: After mature consideration we feel, in the interests of our client, New River Development Company, and in order that the record of proceedings before the Power Commission may be clear, that there are certain records in regard to New River and facts in regard to its flow which warrant a request for reconsideration of the report above mentioned.

We have therefore prepared and take the liberty of sending herewith a memorandum of request for reconsideration of the report, which is hereby respectfully submitted.

We also enclose copy of a memorandum prepared for submission to the Commission, setting forth the position of New River Development Company with reference to its declaration of intention.

We shall be glad to have an opportunity of discussing the matters set forth, with you and your counsel if you desire, at your convenience.

A copy of this letter, with the documents submitted, is being sent to the Federal Power Commission for its files.

Respectfully submitted.

CURTIS, MALLET-PREVOST, COLT & MOSLE.

CMM-12.
Encl.

3634-E *Defendant's exhibit No. 572*

Report of Major General Taylor, Chief of Engineers, dated December 29th, 1925, addressed to the Executive Secretary of the Federal Power Commission, Washington, D. C. The text of this exhibit is the same as the text of Plaintiff's Exhibit 97, but Exhibit 572 was offered and admitted in evidence for all purposes. (Original exhibit.)

3635 *Defendant's exhibit No. 573*

"Defendant's Exhibit No. 505" identified by Col. Edgerton as a part of the minutes subsequently printed as of the minutes of the meeting of June 1, 1927. (Original Exhibit.)

3635-A *Defendant's exhibit No. 574-A*

FEDERAL POWER COMMISSION,
*Washington, July 1, 1927.*

Secretary of War, Chairman. Secretary of the Interior. Secretary of Agriculture. O. C. Merrill, Executive Secretary.

Messrs. CURTIS, MALLET-PREVOST, COLT & MOSLE,
*30 Broad Street, New York, N. Y.*

GENTLEMEN: There are enclosed duplicate copies of the license which it is proposed to issue to the Appalachian Electric Power Company for a power project in the New River near Radford, Pulaski County, Virginia.

If the instruments are satisfactory, it is requested that both copies be signed and returned together with two certified copies of the resolution of the board of directors authorizing acceptance.

The Commission has not yet authorized the granting of this license, but it is expected that such authorization will be given at a future meeting, and in order to expedite matters the drafts are being sent you in advance for acceptance. As soon as the Commission has acted favorably and the accepted drafts have been returned both copies will be executed and the original will be forwarded for the files of the licensee.

A certified copy of that part of the minutes of the Commission's meeting on June 1, showing the action taken on the declaration of intention of the New River Development Company, is enclosed for your information.

It is understood that the company is contemplating modifying its plans. It is requested that with the acceptance of the license it submit the new plans so that they may be approved by the Chief of Engineers and the Secretary of War. The license will then be modified where necessary in order to cite the new exhibits.

Very truly yours,

O. C. MERRILL,
*Executive Secretary.*

3 Incls. #8784, 5, 6.

3635-B *Defendant's exhibit No. 574-B*

I, O. C. Merrill, Executive Secretary of the Federal Power Commission, do hereby certify that the following is a true and correct copy from the record of the proceedings of the Commission in my custody, of that part of the minutes of the eighty-eighth meeting of the Commission, held on the first day of June,

, which refers to the action taken on the declaration of inten-
of the New River Development Company:
In the matter of the declaration of intention, under the provi-
s of section 23 of the Federal water power act, of New River
elopment Company, a corporation organized under the laws
he State of Virginia, to construct a dam and other structures
ss and in New River in the vicinity of Radford, Pulaski
nty, State of Virginia, said dam and other structures being
t of a power project proposed to be constructed for the pur-
, inter alia, of the development and utilization of power,
declaration having been submitted to the Commission under
of June 26, 1925: The Commission having caused investiga-
of such proposed construction to be made and it appearing
such investigation and from reports, submitted thereon that
project, unless operated in the interests of interstate or for-
commerce in accordance with the requirements of said act,
ld have an adverse effect on such interests, but if operated in
ordance with such requirements would materially benefit such
merce, thereupon found that said river in the part thereof
olved in said declaration is not "navigable waters" within the
inition thereof in said act, but that the interests of interstate
foreign commerce would be affected by such proposed
struction."
Witness my hand and the seal of the Federal Power Commis-
n at Washington, D. C., this 16th day of June 1927.

O. C. MERRILL,
*Executive Secretary.*

35–C *Defendant's exhibit No. 574–C*

Form of license entitled "License on Navigable Waters" accom-
nying Exhibit 574–A. (Original exhibit.) Exhibit 574–C is
same as the license which constitutes a part of Exhibit 130
d which is printed at page 2650 hereof.

35–D *Defendant's exhibit No. 575*

Letter dated March 1, 1928, to Hon. Dwight F. Davis, Secy.
War, Hon. Hubert Work, Secy. of Interior, Hon. Wm. N.
rdine, Secy. of Agriculture, constituting the Federal Power
mmission, and signed A. E. P. Co., by Curtis, Mallet-Prevost,
lt & Mosle. (Original Exhibit.)
Exhibit 575 is included in Plaintiff's Exhibit 91 and is set
rth at page 2483 hereof but, unlike Exhibit 91, was admitted
evidence for all purposes.

*Defendant's exhibit No. 576*

Letter dated March 5, 1930, to Lt. Col. M. C. Taylor, Chief Engineer, Federal Power Commission, Interior Building, Washington, D. C., and signed by F. W. Scheidenhelm. (Original Exhibit.)

3635-E *Defendant's exhibit No. 577*

Pages 6, 7, 8, and 9 of the tenth annual report of the Federal Power Commission for the year 1930.

RELATIONS WITH STATES

In most cases the development of water power is primarily a local problem over which the major responsibility should be assumed by the State directly concerned. This principle is embodied in the Federal water power act and, therefore, its administration has required close correlation with the activities of the State agencies. Clearly the Government has the principal obligation in safeguarding the interests of navigation and the Federal properties as may be affected by water-power projects, but in other respects the control of these developments is largely a matter of State interest. Since this situation involves a considerable degree of dual authority, there are present the elements of possible conflict and confusion which might seriously impede desirable developments unless the State and Federal agencies find a basis whereby each may properly supplement and not duplicate the other.

The commission has endeavored to conduct its affairs with the fullest cooperation of the States, and while, in general,
3635-F the relations have been harmonious and mutually helpful, there has been complaint at times that Federal jurisdiction was being stretched unduly. These complaints have related mostly to cases where the commission assumed jurisdiction over projects situated entirely on private land along nonnavigable streams. Obviously there can be no injury to navigation through the direct diversion of the waters of a nonnavigable stream through the turbines of a power plant. In certain cases, however, when a considerable amount of impounding capacity is involved, it has been conceived by the commission that some control over the regulation of the storage would be desirable in order to assure that the navigable waterways lower down may not be deprived of such natural flow as required.

There is no requirement in the law which compels the builder of a project on a nonnavigable stream to come before the com-

mission, but if he elects to do so by filing a declaration of intention pursuant to section 23 of the act and the commission thereupon finds that the project may have some effect on navigable waterways, it has been considered that the construction of the project could then be permitted to proceed only under a license authorization in the same form as for projects in navigable waters. The law contains no express authority for the issuance of licenses for such projects on nonnavigable streams, but the authority to do so seemed a suitable inference from the provisions of section 23.

The proceedings of this character before the commission have not been numerous and licenses have been issued in only five cases. Nevertheless, a number of the States look upon the practice as the beginning of far-reaching usurpation of power by the Federal Government which will inevitably lead to serious conflict with the functions properly belonging to the States. They challenge the constitutionality of the Government's jurisdiction in so far as it may be extended beyond the limits actually necessary for the protection of navigation and contend that the encroachment upon their rightful field of activity introduces confusing duplication of authority. They assert that they are thoroughly capable of managing the development of their own water resources and that interference by the Federal Power Commission on nonnavigable streams is substantially hampering development under the State laws.

The position of the States in the matter is fully illustrated by the communications from Governor Horton, of Tennessee, Governor Conley, of West Virginia, and Chairman Carson, of the Virginia State Conservation and Development Commission, which are included in the appendix to this report. In order that the commission might have reliable guidance on the legal aspects of the question, the advice of the Attorney General of the United States was requested relative to the pending application

3635–G for a development on New River referred to in the letter from the Virginia authorities. In an opinion rendered September 22, 1930, the Attorney General concluded:

"Upon the facts stated by the commission in this case the United States has no power to prevent the construction of the proposed project on the New River unless its operation will tend to impair the navigability of the Kanawha River by changing the normal and regular flow of the stream; and the only interest which the United States has to protect, and for which it may be justified in issuing a license, is a very minor part of the complete project, viz, the manner in which the flow of the stream below the dam is affected by the operation of the water power. I am advised by a

representative of the commission that, under a license providin merely for proper control of the retention and release of wate this project will tend to improve the navigability of the Kanawh River. Under these circumstances every purpose within th power of Congress may be accomplished by the issuance of minor-part license under paragraph (i) of section 10. Accord ingly, I am of the opinion that the most reasonable constructio of this statute is that paragraph (i) of section 10 was intended t have application in such a case provided the interests of th United States may be fully protected by the issuance of a licens to control the flow of the stream and/or to use physical instru mentalities which may be constructed for this purpose, the con ditions of such license to be fixed by the commission in its di cretion under section 10 (i) of the act.

"This interpretation appears necessary in order to avoid se rious questions regarding the constitutionality of the act whic might be presented if section 10 (i) should be interpreted so a to have no application to projects constructed in or on non navigable streams, which only remotely and indirectly affect th navigability of waters in the lower reaches of streams to whic they are tributaries. If paragraph (i) of section 10 is not ap plicable in such cases, the commission would in no such case b authorized to waive any of the conditions specified in section 10 because section 23 prohibits any such construction, once the com mission finds that the interests of interstate or foreign commerc will be affected, until a license is issued under the provisions o the act. To hold that the commission has full authority unde this section to exercise its discretion in granting a minor-part license in this case leads to a reasonable construction of the statute and a full accomplishment of its legislative purpose.

"This interpretation of paragraph (i) of section 10 finds some support in the administrative construction of the act adopted by the commission on May 23, 1925, in its consideration of several applications (Project No. 15) of Hydraulic Race Co. and other corporations, reported in the fifth annual report of the Federal Power Commission, 1925, at pages 111 and 112.

"In answering the questions proposed by the commission, I have accordingly to advise you that it is my opinion that the commission may, in its discretion, issue a minor-part license under paragraph (i) of section 10, for the construction and op eration of the project here in question; that it is not required to insert in a license issued for this project, any conditions (except the 50-year limitation upon the terms of the license) which, in its judgment, are not necessary or appropriate to fully utilize the waters of the New River in the protection or development of navigation of the Kanawha River."

The full opinion will be found in Appendix B [14] together with a communication from Governor Parnell, of Arkansas, which affords further information regarding the attitude of the States.

3635–H It is possible that licenses restricted to the terms essential for safeguarding the navigation interests will serve the essential Federal interests and at the same time overcome the objections advanced by the States. The control over projects of this class is fundamentally a function of the States, and it seems appropriate that the Federal relationship should be conformably subordinated to an extent consistent with the protection of recognized Federal interests.

3636 *Defendant's exhibit No. 578–A*

Letter dated October 3, 1930, to Gen. Brown, Chief of Engineers, and signed by F. E. Bonner, Exec. Secy. (Original Exhibit.)

*Defendant's exhibit No. 578–B*

Letter dated October 10, 1930, to the Exec. Secy., F. P. C., Washington, D. C., signed for the Chief of Engineers, by Hugh J. Casey, First Lieut. Corps of Engineers. (Original Exhibit.)

3637 *Defendant's exhibit No. 579–A*

Photostatic copy of letter dated November 5, 1930, to Exec. Secy. F. P. C. and signed by Lytle Brown, Major General, Chief of Engineers.

*Defendant's exhibit No. 579–B*

Photostat of report entitled "Second endorsement U. S. E. O. Huntington, W. Va., Oct. 18, 1930, Div. Engineer, Upper Miss. Valley Division, St. Louis, Mo., signed by Major Herman, District Engineer."

*Defendant's exhibit No. 579–C*

Photostat copy of report on navigability of New River, Va. (Huntington District, August 29, 1930.) Third endorsement, office, Division Engineer, Upper Miss. Valley Div., St. Louis, Mo., October 24, 1930, to Chief of Engineers, U. S. Army, Washington, and signed George R. Spalding, Lt. Col. Corps of Engineers.

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[14] See page 149.

3638 *Defendant's exhibit 579–A, B, C*

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
*Washington, Nov. 5, 1930.*

Refer to File No. 6371 (New River, Virginia) 9.

The EXECUTIVE SECRETARY,
*Federal Power Commission.*

DEAR SIR: Transmitted herewith for your information a copies of reports of the District Engineer, Huntington, We Virginia, and the Division Engineer, Upper Mississippi Valle Division, on the navigability of the New River, particularly Jacksons Ferry, Wythe County, and Glenlyn, Giles Count Virginia.

Very respectfully,

(Signed) LYTLE BROWN,
*Major General, Chief of Engineers.*

2 inclos., viz; Photostat copies of 2d & 3d Inds. on 6371 (Ne River, Va.) 9.

(2d Ind.) JFR:MD

U. S. E. O., HUNTINGTON, W. VA.,
*October 18, 1930.*

To the DIVISION ENGINEER,
*Upper Miss. Valley Division, St. Louis, Mo.*

1. In compliance with instructions contained in 1st Ind., th following report is submitted on the navigability of New Riv at Jackson's Ferry, Wythe County, and at Glenlyn in Gil County, Virginia.

2. The New River has its source in the Allegheny Mountai in the northwest corner of the State of North Carolina. Th North and South Forks unite near Weatherford Postoffice, Nort Carolina, to form New River. It flows thence, crossing the Vi ginia-North Carolina State boundary line three times in the fir nineteen miles, for a distance of 115 miles to Pepper
3639 Ferry, Virginia. From this point to its mouth at th junction with Gauley River, the stream flows in a nort westerly direction, through the states of Virginia and West Vi ginia, for a distance of 140 miles. From source to mouth Ne River traverses a rugged, mountain country. Its bed is gene ally narrow and tortuous, is interrupted by numerous rapids an falls, and has an unstable regimen. The Gauley and the Ne River unite to form the Kanawha River. The last-named is navigable tributary of the Ohio River.

3. The following tabulation gives the distance in miles above its mouth and the elevation in feet above sea level of the low water surface at such points, of some of the places along the course of the river which will be referred to.

| Point on New River | Miles above mouth of New River | Approximate ele. feet L. W. surface above mean sea level |
|---|---|---|
| Mouth of New River | 0 | 650 |
| Mouth of Greenbrier River near Hinton, W. Va | 65 | 1365 |
| W. Va.-Virginia, State Line | 87 | 1460 |
| Glenlyn, Virginia | 94 | 1495 |
| Pepper's Ferry | 140 | 1745 |
| Radford project dam site | 151.1 | 1790 |
| Jackson's Ferry, Va | 185 | 1925 |
| Lead Mines | 189 | 1955 |
| Buck Power Dam | 195 | 2000 |
| Byllesby Power Dam | 198 | 2060 |
| Washington Mills Power Dam | 207 | 2190 |
| Forks River, Weatherford, N. C | 255 | 2490 |

4. Under authority of the appropriation act approved June 10, 1872, an examination and survey of New River was made during the low water period of August 1872. This covered the river from the mouth of the Greenbrier to the Lead Mines in Wythe County, Virginia. The resulting report is contained in the Report of the Chief of Engineers for the year 1873, pages 842 to 854. A detailed description of the river, mile by mile, commencing at the "Lead Mines," is given on pages 845 to 848, inclusive, to which reference is made.

5. At the time the examination and survey was made a limited amount of transportation by keel-boats of two or three tons capacity drawing about 12 inches was being carried on probably only at favorable stages of the river and in certain
3640 stretches. The report considered two plans of improvements.

(a) An improvement estimated to cost $100,000 to facilitate 2-foot keel-boat navigation.

(b) An improvement estimated to cost $1,017,000 to afford 3-foot navigation, with so much reduction of grade at the numerous falls and rapids as would permit a small stern-wheel steamer to ascend with two barges in tow, even if at a few points, the ascent were required to be made by hauling up by ropes attached to fixed points above and to the drum of the steam engine.

6. In 1878 examination and survey was extended above the Lead Mines a distance of 62 miles, the results being printed in the annual reports of the Chief of Engineers for 1879, pages 538 et seq., to which reference is made.

7. The original project was adopted in 1876, was of an experimental nature, and provided for improving the stream from the mouth of the Greenbrier to the Lead Mines with a view to facilitating keel-boat navigation. The sum of $109,691.06 was expended on such work up to June 30, 1898. With this expenditure, a navigable channel 50 feet wide and 2 feet deep was secured for a distance of 26 miles above the mouth of the Greenbrier. A channel two feet deep and of varying width of from 10 to 30 feet was secured for a distance of about 20.5 miles from mile 145.8 to mile 175.3. There was also some work done above the Lead Mines in securing a 2-foot depth channel by 20-foot width for a distance of five miles.

8. The above experimental work when executed by the Government only slightly altered the natural difficulties of navigation. In the year 1882 after most of the expenditure had been made, the commerce on the river was reported to be about eleven thousand tons, and this, and such other commerce as has since existed, was local and was apparently confined to a section within a distance of 25 miles above the mouth of the Greenbrier. Waterborne commerce has now entirely disappeared from the river, except for ferrys at various places and these are being rapidly replaced by bridges as hard surface roads are being extended.

3641 9. As far as known, 23 bridges have been built across New River between the mouth of the Greenbrier and the forks of the river. There is nothing on record indicating that plans for these bridges were approved by the Department. In addition, the two bridges referred to in the basic letter, are now under construction by the Virginia Department of Highways.

10. The Appalachian Electric Power Company has built and operated since 1912 without Congressional authorization or Departmental permission, two power dams on New River at Buck and Byllesby, located at miles 195 and miles 198, respectively. The Washington Mills power dam located at Mile 207 was built under authority of an act of Congress approved June 4, 1900 (34 Stat. L. 264). Construction of other power dams is under consideration at Radford dam site, at two other sites just above the mouth of the Greenbrier, and at one site at Hawk's Nest 7.5 miles above the mouth of New River.

11. On September 30 and October 1 and 2, respectively, 1930, The Public Service Commission of West Virginia held a hearing in Charleston, West Virginia, on the application of the West Virginia Power Company for a permit to construct the two dams proposed to be built on New River just above the mouth of the Greenbrier River, and referred to in the preceding paragraph. At this public hearing ex parte testimony was introduced

the company relative to the navigability of that portion of
w River between the mouth of the Greenbrier River and the
ginia State line. A copy of the transcript of this testimony
s secured and is transmitted herewith. This testimony tends
how that the stream is not navigable in fact.

2. Investigation and survey under authority of House Docu-
nt 308, 69th Congress, First Session, is now under way of the
nawha River and its tributaries. While this study has not
n completed, it appears improbable that any new or different
ht will be thrown on the question of present navigable capacity
l feasibility of navigation improvement on New River if such
undertaken in combination with power development and flood
trol, than has already been revealed by past surveys. This
stream, however, has been generally recognized as having
2 valuable power possibilities, and this view has been con-
firmed by the investigation. The river with its large run-
and its steep gradient is believed to possess a wealth of un-
veloped water pow . The fullest utilization of its water sup-
would result from comprehensive development including
ficient storage on the headwaters to impound the flood waters
hold-over storage, and with auxiliary storage on the tribu-
ies and the main stream below to complete the discharge regu-
ion. It would appear that such plan is feasible for partial
d ultimate complete development, provided it be taken in hand
time to define reservoir limits before new highway or railroad
nstruction within the present flood plain, with resultant in-
ase in costs, makes river development unduly costly. In the
sence of constitutional and congressional authority over non-
vigable streams where there are no public riparian lands, it is
t clear at this writing how the Federal Government may law-
lly, in the absence of full and voluntary cooperation of all
ate and private interests, exercise control over the situation
fficient to secure the fullest utilization of the water resources
New River for the common advantage of the public.

3. It is understood that the matter of navigability, within
e scope of the meaning of the commerce clause of the Con-
tution, is a mixed question of law and fact upon which, for
ultimate determination, the Federal courts must pass. Expert
inion of officers of the executive branch of the Government has
ly the force of evidence of the fact.

4. On August 20, 1925, the Chief of Engineers, U. S. Army,
vised the Secretary of the Federal Power Commission in the
atter of the navigability of New River as follows: (Par. 18
D 7495 (New River Development Co.) 3.)

"From the above facts it is established that New River has been under Federal improvement for navigation, that navigation has actually existed and that the river was physically capable of interstate navigation although very light draft. * * * If free from any control by the United States it would be difficult to ascertain authoritatively that the proposed development would be in general accord with the most beneficial utilization of
3643 the water for navigation, water power, flood control and other beneficial public uses. It is obvious that such utilization is essential to the best interests of commerce. Therefore, while the navigable capacity of the stream is limited, this office must report that no sufficient reason is seen why the Federal Power Commission should not exercise jurisdiction over the proposed project."

15. In a letter dated December 29, 1925, to the Executive Secretary, Federal Power Commission, the Chief of Engineers (ED 7495 (New River Development Co.) 18), for reasons stated therein, qualified his letter of August 20, 1925, above quoted, regarding the navigability of New River, and after consulting the law, as exemplified in decisions of the United States Supreme Court bearing on the question of navigability, and after reviewing the facts disclosed by the examination and survey reports of the 1872 and 1878, supra, concluded (last paragraph of the letter):

"I, therefore, report that in my opinion New River in its present condition is not a navigable stream * * *"

16. After review of all of the facts, the District Engineer has reached the conclusion that New River, especially in the vicinity of the highway bridges now under construction over that stream by the Commonwealth of Virginia, Department of Highways, at Glenlyn, Virginia, and Jackson's Ferry, Virginia, respectively, is not susceptible of being used in its natural or ordinary condition, as a highway for commerce over which trade and travel may be conducted in the customary modes of trade and travel on water, nor does it afford in its natural and ordinary condition a channel for useful commerce. It is the District Engineer's opinion, therefore, that New River is not navigable in fact either at Jackson's Ferry or Glenlyn, or at any other point in its course.

(Signed) FRED W. HERMAN,
*Major, Corps of Engineers,*
*District Engineer.*

6 incls: 5 incls. accomp'g. unchanged. 1 added—Transcript of testimony before The Public Service Com. of W. Va. (Single copy.)

3644 6371 (New River, Va.)–1

Subject: Navigability of New River, Va.

(Huntington District, Aug. 29, 1930)

Ht 12–1/1 (3d Ind) GRS:MK.

OFFICE, DIV. ENGR., UPPER MISS. VALLEY DIV.,
*St. Louis, Mo., Oct. 24, 1930.*

To the CHIEF OF ENGINEERS, U. S. Army,
*Washington, D. C.*

1. Returned.

2. The District Engineer's report in 2d indorsement hereon is quite complete. The following additional information, quoted from report submitted by Assistant Engineer N. H. Hutton to Col. W. P. Craighill, Corps of Engineers, under date of Dec. 17, 1872, (P. 845, Report of Chief of Engineers, 1873), has been also of value to me in arriving at my opinion:

"In the upper portion of the river, for thirty-five or forty miles, the pools are generally very short, whole miles being composed of ledges of slate or limestone, 200 or 300 feet apart, with small pools between. In the lower portion, though the rapids are more concentrated, yet even there the pools will hardly average more than one mile in length." (Jackson's Ferry and Glenlyn lie in the upper section, above described.)

The average fall per mile in the entire distance from the "lead mines" to the mouth of the Greenbrier (128 miles) is given by Hutton as about 4½ feet, "a grade", as he expresses it, "that if equally distributed throughout, would offer no impediment to such navigation as the country along the river has need of."

* * * * * * *

"The present wants of this region would be met by any system of improvement which would afford 3 feet depth of water during the lower stages of the river. With only so much reduction of grade at the falls and rapids as would permit a small stern-wheel steamer to ascend with two barges in tow, even if at a few points, the ascent required to be made by hauling up by ropes attached to fixed points above and to the drum of the steamboat engine.

"The extent of the improvement can be accomplished except at Foster's Falls, by clearing out sluiceways through the shoals and rapids, at nearly their natural grades and by opening
3645 through the vertical falls and ledges, sluces with a slope not exceeding 1 to 10."

* * * * * * *

"The present system of transportation on this portion of the river is by keel-boats, which carry from two to three tons, and are rowed or floated down the river and poled up."

"The improvement, if effected, would, in about forty miles below the lead mines, intersect the Virginia and Tennessee Railroad, and the Chesapeake and Ohio (Railroad) at the mouth of the Greenbrier, thus opening to both eastern and western markets a large area of productive country, now practically shut up."

3. It is my opinion that the characteristics of the river as above described were not such as to make it, in its natural state, susceptible of anything but a very precarious and occasional use by very light draft keel-boats, at times of normal high water. The improvements made by the United States rendered the river safer for the floating of timber and keel-boats at high stages as may be seen from the following quotation, (P. 538, Report of Chief of Engineers, 1879):

"Many of the old batteaux channels and 'notches' are so narrow and crooked that rafting is attended with a good deal of risk; our channels being wide enough for the rafts, will render the passage of the shoals comparatively safe."

Steamboat navigation, though attempted by a steamer designed to draw 12 inches, was not successful.

4. It is my further opinion that the river was not made navigable in fact except for precarious and occasional navigation by the Federal improvements, and that it is not now navigable in fact or capable of being made so at any reasonable expense. The balance of the improvement appropriation was directed to be paid into the Treasury of the United States by the R. & H. Act approved June 13, 1902, which repealed the project.

5. The above applies to the river above the mouth of the Greenbrier. Below that stream, the slope of the river increases
3646 to double that of the reach described.

6. I therefore concur in full with the District Engineer in his statement that "New River is not navigable in fact either at Jackson's Ferry or Glenlyn, or at any other point in its course."

(Signed) GEO. R. SPALDING,
*Lieut. Col., Corps of Engineers,*
*Division Engineer.*

Inclos.—Transcript of Testimony before The Public Service Com. of W. Va.:
Copy of Ser. 1—Ltr. of Sen. Swanson,
Copy of Sub. 1—of Ser. 1—Letr. of Hon. H. G. Shirley,
Copy of E. D.—Ltr. to Sen. Swanson dated 8-25-30,

Copy of Extracts from Decision of Supreme Court on navigabi'ty Red R.
Copy of Extracts from Decision of Supreme Court re Navigable Waters.

47 *Defendant's exhibit No. 580*

Memorandum dated October 21, 1930, entitled "Memorandum Exec. Secy." and signed by J. F. Lawson, acting Chief unsel. (Original Exhibit.)

47–A *Defendant's exhibit No. 581*

OCTOBER 30, 1930.

P–739–Virginia. Appalachian Electric Power Co.

MEMORANDUM FOR THE SECRETARY OF THE INTERIOR, ACTING CHAIRMAN

Pursuant to opinion of the Attorney General, dated September , 1930, concerning the application for the New River project No. 739), we have proceeded with the preparation of the case r presentation to the Commission. The draft of license, following the minor-part form, was prepared by the Engineering ivision and upon submission to the Legal Division for review e Acting Chief Counsel declined to approve the instrument for e reasons set forth in his memorandum of October 21; attached ereto.

Mr. Lawson advances the theory that the Commission made a istake in finding by formal action of June 1, 1927, that the ction of the river at the location of the project is nonnavigable nd urges that the Commission should now reverse the finding nd declare the stream to be navigable. He also takes the position that notwithstanding specific statements by the State of irginia authorities there may be some question as to whether he company has complied in all respects with the State laws.

I asked the Chief Engineer of the Commission for comment n Mr. Lawson's objections and Colonel Tyler's memorandum of October 28 is attached hereto. It will be observed that he feel hat Mr. Lawson's arguments on all points are without any sound foundation. Colonel Tyler's statement is very clear as
647–B to the actual facts bearing on the situation and I am convinced that his position is entirely correct.

Inasmuch as the divergent views on this case will come before he Commission when the application is presented at the next neeting, it occurred to me that you might desire to have the pportunity of some preliminary study. Extra copies of the

accompanying papers may be supplied in case you wish to have them for the other two members of the Commission.

F. E. BONNER,
*Executive Secretary.*

Att.
FEB/ccm.

3647-C *Defendant's exhibit No. 582*

NOVEMBER 8, 1930.

S-Cooperation State of Virginia

Hon. JOHN G. POLLARD,
*Governor of Virginia,*
*Richmond, Virginia.*

DEAR GOVERNOR POLLARD: There is pending before this Commission a license application filed by the Appalachian Electric Power Company for a proposed project on New River near Radford, Virginia. The desirability of prompt action in respect to this application was pointed out by Mr. William E. Carson, Chairman of the State Commission on Conservation and Development, in letter of October 30, and of course the Commission is anxious to cooperate with the State authorities in any measures which may serve to relieve unemployment conditions and stimulate industrial development. We are endeavoring to prepare the case for early consideration by the Commission, but one question not entirely settled concerns the compliance with State laws.

The Federal water power act requires "that each applicant for a license hereunder shall submit to the Commission * * * satisfactory evidence that the applicant has complied with the requirements of the laws of the State or States within which the proposed project is to be located with respect to bed and banks and to the appropriation, diversion, and use of water for power purposes, and with respect to the right to engage in the business of developing, transmitting, and distributing power, and in any other business necessary to effect the purposes of a license under this act."

From the evidence submitted by the applicant, there seems to be no question as to its qualification to "engage in the business of developing, transmitting, and distributing power" as contemplated in connection with the project, and the applicant company has filed a copy of a letter, dated June 16, 1930, signed by Wm. Meade Fletcher, Chairman of the State Corporation Commission, which indicates proper compliance with the provisions of the Virginia Water Power Act. In order, however, that the Commission may be assured that the company has complied fully

with all State laws contemplated by the above-mentioned provision of the Federal act, the Commission would appreciate your advice in the matter.

Very truly yours,

F. E. BONNER,
*Executive Secretary.*

Copy to Mr. Carson.
FEB/ccm.

3647-D *Defendant's exhibit No. 583*

COMMONWEALTH OF VIRGINIA,
GOVERNOR'S OFFICE,
*Richmond, November 10, 1930.*

Mr. F. E. BONNER, *Executive Secretary,*
*Federal Power Commission,*
*Washington, D. C.*

DEAR MR. BONNER: In reply to your letter of November 8th, in which you inquire whether the Appalachian Electric Power Company, a Virginia corporation, which has applied to your Commission for a license for the construction of a hydro-electric development on the New River near Radford, Virginia, has complied with all laws of this State contemplated under the section of the Federal Water Power Act mentioned in your letter, I have referred your inquiry to the proper departments of the State Government and am advised that this company has complied with all laws of this State having any connection with this proposed project.

I am pleased to note from your letter that this matter will be given early consideration by your Commission and trust that there may be no delay in the issuance of the license.

Very truly yours,

JNO. GARLAND POLLARD,
*Governor.*

3647-E *Defendant's exhibit No. 584*

Letter Jan. 27, 1931 from Curtis, Mallet-Prevost, Colt & Mosle, to F. P. C. re Project #739. (Original Exhibit.)

*Defendant's exhibit No. 585*

Telegram dated January 28, 1931, from F. P. C., signed by George Otis Smith, Chairman, Addressed to A. E. P. Co. (Original Exhibit.)

3647–F *Defendant's exhibit No. 586*

SEPTEMBER 13, 1934.

Hydro-Electric Project of Appalachian Electric Power Co. on New River near Radford, Va.

THE SECRETARY OF WAR,
*Washington, D. C.*

SIR: For many years Appalachian Electric Power Company, a Virginia Corporation, and its predecessors have been desireous of constructing a hydroelectric project on New River in Virginia about four miles upstream from Radford, Virginia. To this end a "declaration of intention" was made to the Federal Power Commission in 1925 by New River Development Company, a predecessor corporation.

It had been assumed by those responsible for filing that declaration that the Federal Power Commission would not merely take action consonant with the repeated holdings by the Chief of Engineers, U. S. Army, that New River is nonnavigable, but also would find no other basis for attempting to take jurisdiction over the project. Instead, however, the Federal Power Commission sought to take jurisdiction over the project upon the alleged ground that the interests of interstate or foreign commerce would be affected by the proposed construction.

Despite the fact that this company believes that there is no lawful basis for such attempted exercise of jurisdiction by the Federal Power Commission, it has for more than six years consistently expressed its willingness to accept from the Federal Power Commission a license containing such conditions, but only such conditions as are reasonably designed and necessary to protect the navigable waters of the United States and in particular to protect the navigability of Kanawha River, to which the nonnavigable New River is tributary. The Commission, on the other hand, has refused to issue such a license and about April 3, 1931, ordered the company not to proceed with the construction of its project until it shall have received and accepted a so-called standard license, containing many conditions unrelated to the protection of navigation.

Thereupon this company endeavored unsuccessfully to have the issues in point adjudicated in the Courts.

The Company holds a license from the State Corporation Commission of Virginia and has complied with Vir-

3647–G ginia laws in all other respects.

The various negotiations between the company and the Commission were well known to predecessor Secretaries of War

so long as the Secretary of War was ex-officio a member of the Federal Power Commission, viz, until late 1930. Also the records of the Chief of Engineers contained much information upon this matter in view of various pertinent reports which the Chief of Engineers has been called upon to make by request of Federal Power Commisssion and otherwise.

It is desired to acquaint you with the present status of the matter to wit:

On June 12, 1934, the Board of Directors of this company adopted the following resolution:

"Whereas, Appalachian Electric Power Company and its predecessors have expended more than three quarters of a million dollars in the acquisition of lands and flowage rights and more than three quarters of a million dollars additional in investigations of dam and reservoir sites, surveys, highway and railroad construction work and other construction work, solely useful and valuable to it for the purpose of constructing a hydroelectric development on the nonnavigable New River in Pulaski County, Virginia; and

"Whereas, the Company has at all times been advised and believed and is now advised and believes that neither the Federal Power Commission nor the Federal Government has any power to require the acceptance of any license (and particularly a so-called standard form of license such as was sought to be required by the order of the Federal Power Commission) as a condition of the construction or operation of this project; and

"Whereas, nevertheless, in deference to the Federal Power Commission and the Government of the United States, this company made a serious effort to have any possible right of either in connection with this project judicially determined; and

"Whereas, that attempt was frustrated and a determination on the merits prevented by the fact that the then members of the Federal Power Commission failed to enter their appearances and raised technical jurisdictional questions; and

"Whereas, the heavy investment already made by the company and the results of its construction work to date have been lying idle and the orderly development of the company's business now requires the completion of this hydroelectric plant and the company has again submitted the matter to counsel and is again advised that since the project is located on a nonnavigable stream and neither the construction nor the operation of such

3647–H project will adversely affect the interests of Interstate commerce on the lower navigable waters, to wit: The Kanawha River, the Federal Government and the Federal Power Commission are without power to interfere with the construction

and operation thereof or to require therefor the acceptance of any license as a condition of such construction and operation,

"Now, therefore, be it,

"Resolved, that the officers of this company are directed to resume construction and to continue to construct and upon completion of construction to operate said hydro-electric development unless and until lawfully compelled to desist therefrom by the order of a competent Court,

Be it further

"Resolved: That a copy of this resolution be transmitted to the Federal Power Commission, with the assurance that this action is taken with great deference but in full reliance upon what this company believes to be its rights, in order that the Commission, if it takes a different view of the law involved, may be apprised that the company is resuming construction and adding to its already large expenditures made by it upon the project."

Thereupon, this company promptly resumed the construction of its hydroelectric project and is continuing such construction.

Although this company, upon the advice of counsel, takes the position that the Federal Power Commission has no lawful jurisdiction over the project, it recognizes fully the authority and duty of the Secretary of War to protect the navigability of Kanawha River. Such duty and authority are believed to have been imposed upon and vested in the Secretary of War by the Congress through its Rivers and Harbors Act of March 3, 1899, and in particular, as regards the non-navigable New River, by virtue of Section 10 of that Act.

This company can and will so conduct the construction and the subsequent operation of its hydroelectric project that there will not result any obstruction to the navigable capacity of the Kanawha River or any other navigable waters of the United States. Indeed, it is improbable that under any reasonably conceivable method of construction or operation any such obstruction to navigation could arise. If, however, contrary to the apparent facts, there should arise some possibility of obstruction to navigability, this company is ready to recognize and abide by any and all requisite orders or regulations of the Secretary of War forbidding any method of construction or operation if and to the extent that obstruction to navigability results therefrom.

In the meantime this company asserts its willingness and desire to cooperate fully with the appropriate representatives of the War Department in pursuance of its good faith in the premises.

Respectfully submitted,

APPALACHIAN ELECTRIC POWER COMPANY,
By GEORGE N. TIDD, *President.*

3647–I *Defendant's exhibit No. 587*

WAR DEPARTMENT,
*Washington, October 9, 1934.*

E. D. 7245 (Appalachian Elec.-Pow. Co.) 35
Attention: Mr. George N. Tidd, President

APPALACHIAN ELECTRIC POWER CO.,
*30 Church Street, New York, New York.*

DEAR SIR: The Department is in receipt of your letter of September 18th, advising that your company has "resumed the construction of its hydroelectric project" on the New River, Virginia, and asserting that "this company can and will so conduct the construction and the subsequent operation of its hydroelectric project that there will not result any obstruction to the navigable capacity of the Kanawha River or any other navigable waters of the United States". You further state that "if, however, contrary to the apparent facts, there should arise some possibility of obstruction to navigability, this company is ready to recognize and abide by any and all requisite orders or regulations of the Secretary of War forbidding any method of construction or operation if and to the extent that obstruction to navigability results therefrom."

In view of the fact that in this matter the Federal Power Commission has already made findings "that New River, from the mouth of Wilson Creek, Virginia, north, is navigable waters within the definition thereof, as set forth in Section 3 of the Federal Water Power Act" and that "the interests of interstate or foreign commerce would be affected by such proposed construction" of the proposed project, this Department considers that the requisite regulations for the operation of the project to prevent impairment of the navigable capacity of the navigable waters of the United States should be contained in the license of the Federal Power Commission for the constructing, operating and maintaining of the project works.

Sincerely yours,

G. H. DERN,
*Secretary of War.*

3648 *Defendant's exhibit No. 588*

OCTOBER 18, 1934.

Honorable GEORGE H. DERN,
*U. S. Secretary of War,*
*War Department, Washington, D. C.*

DEAR SIR: Appalachian Electric Power Company acknowledges the receipt of your letter of October 9 in reply to the letter of this

company of September 18 advising the Secretary of War that the company has resumed the construction of its hydro-electric project on New River, Virginia.

Note is taken of the view of the War Department that "The requisite regulations for the operation of the project to prevent the impairment of the navigable capacity of the navigable waters of the United States should be contained in the license of the Federal Power Commission for the constructing, operating and maintaining of the project works." In this respect, however, this company is advised by its counsel that the Federal Power Commission has no jurisdiction whatsoever over its project and specifically that the Commission has no right to impose, and this company is under no duty to accept, with regard to its project works, any license such as the Commission, by virtue of its order of April 3, 1931, sought to impose upon this company. Consequently, this company does not seek and will not accept such license from the Commission.

Note is taken also of your reference to a certain finding on the part of the Federal Power Commission "that New River, from the mouth of Wilson Creek, Virginia, North, is navigable waters within the definition thereof, as set forth in section 3 of the Federal Water Power Act." In this connection we call your attention to the fact that the Federal Power Commission itself on June 2, 1927, with regard to this very project on New River, made the finding

"that said river in the part thereof involved in said declaration is not 'navigable waters' within the definition thereof in said Act. * * *."

In fact, it was not until October 12, 1932—about sixteen months after this company had instituted proceedings for the adjudication of its controversy with the Commission—that the Commission, without notice to or hearing of this company, made the self-serving finding which is cited in your letter.

3648-A

This company continues in its insistence that New River is non-navigable and in this position it is supported by the fact that reports of various Chiefs of Engineers of your Department have repeatedly and authoritatively declared New River to be non-navigable.

Nevertheless, this company desires to make plain that it does not deny, but has at all times recognized, the power and duty of the Secretary of War to protect the navigable capacity of the navigable waters of the United States. Specifically, since the non-navigable New River empties into the navigable Kanawha River, the company, while asserting that its project will be so operated as not to impair the navigability of any navigable waters, recognizes the power of the Secretary of War to impose, and the duty of the company to comply with, such reasonable regulations, if any, as may be necessary and proper to prevent any actual or threatened obstruction to the navigable capacity of the Kanawha River.

Respectfully yours,

APPALACHIAN ELECTRIC POWER COMPANY,
GEO. N. TIDD, *President.*

3648-B *Defendant's exhibit No. 589*

Letter dated September 18, 1934, to Hon. Frank R. McNinch, Chairman, F. P. C., signed by Appalachian Electric Power Company, by George W. Tidd, President. (Original Exhibit.)

*Defendant's exhibit No. 590*

Letter dated October 19, 1934 to Frank R. McNinch, Chairman, F. P. C., without signature but counsel for both sides agreed that it was signed by M. F. Millikan, General Counsel of the Company. (Original Exhibit.)

*Defendant's exhibit No. 591*

Photostat copy of letter to M. F. Millikan, American Gas and Electric Company, signed by G. W. Lineweaver, Secretary, Federal Power Commission, dated October 23, 1934. (Original Exhibit.)

*Defendant's exhibit No. 592*

Map showing locations of certain photographs from 61 to 113, both inclusive of New River. (Original Exhibit.)

3651–D *Defendant's exhibit No. 599*

Chart upon which Dr. Mead made diagram in connection with his testimony, pertaining to stream flow. (Original Exhibit.)

3654 *Defendant's exhibit No. 601*

House Document No. 306, 74th Congress, First Session, entitled "Ohio River, letter from the Sec. of War transmitting, pursuant to Section 1 of the River and Harbor Act approved January 21, 1927, and section 10 of the Flood Control Act approved May 15, 1928, a letter from the Chief of Engineers, United States Army, dated August 14, 1935, submitting a report, together with accompanying papers and illustrations, containing a general plan for the improvement of the Ohio River for the purposes of navigation and efficient development of its water power, the control of floods, and the needs of irrigation." (Original Exhibit.)

3654–A *Defendant's exhibit No. 602*

This Exhibit is the Table 45, Appendix A, referred to in paragraph 263, page 146, of Exhibit 601. The Appendices to the reports otherwise embodied in House Document No. 306 (being Exhibit 601) were not printed as part of that document. (Original Exhibit.)

3654–B *Defendant's exhibit No. 603*

Photostat of cover page of document entitled "The Ohio River Chart, drawings and description of features affecting navigation, navigable depths and tables of distances for its tributaries, compiled under the direction of the Chief of Engineers, United States Army," and also photostat of page 267 of that document. (Original Exhibit.)

3654–C *Defendant's exhibit No. 604*

Copy of letter dated June 13, 1936 from Mr. Baker to the late Sec. of War, Mr. Dern. (Original Exhibit.) (Printed as part of motion at fol. 98, supra.)

*Defendant's exhibit No. 605*

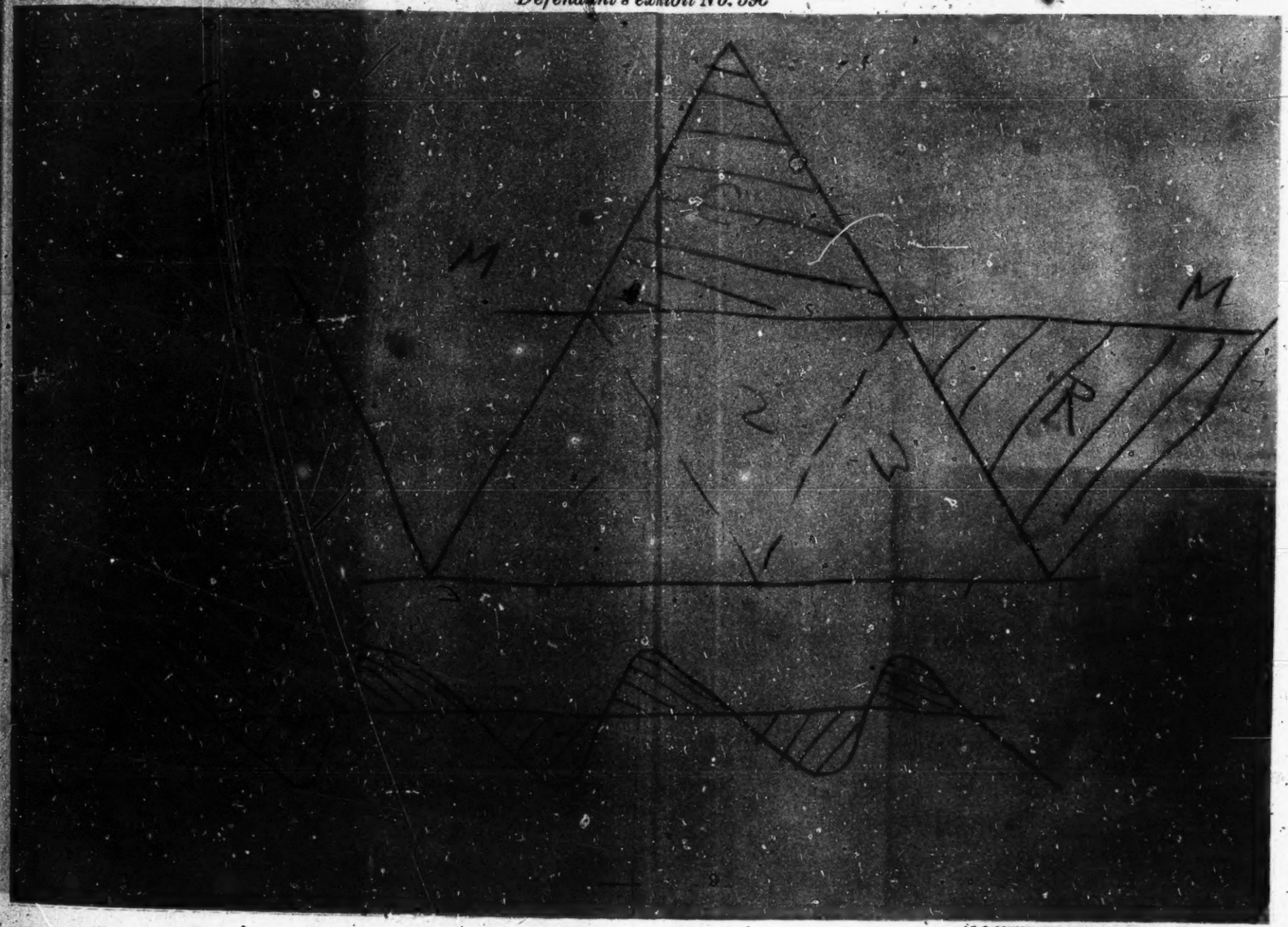
Reply of S. D. Embick, Acting Secretary of War to Mr. Baker, dated June 22, 1936. (Original Exhibit.) (Printed as part of motion at fol. 99, supra.)

Defendant's Exhibit No. 594

8649

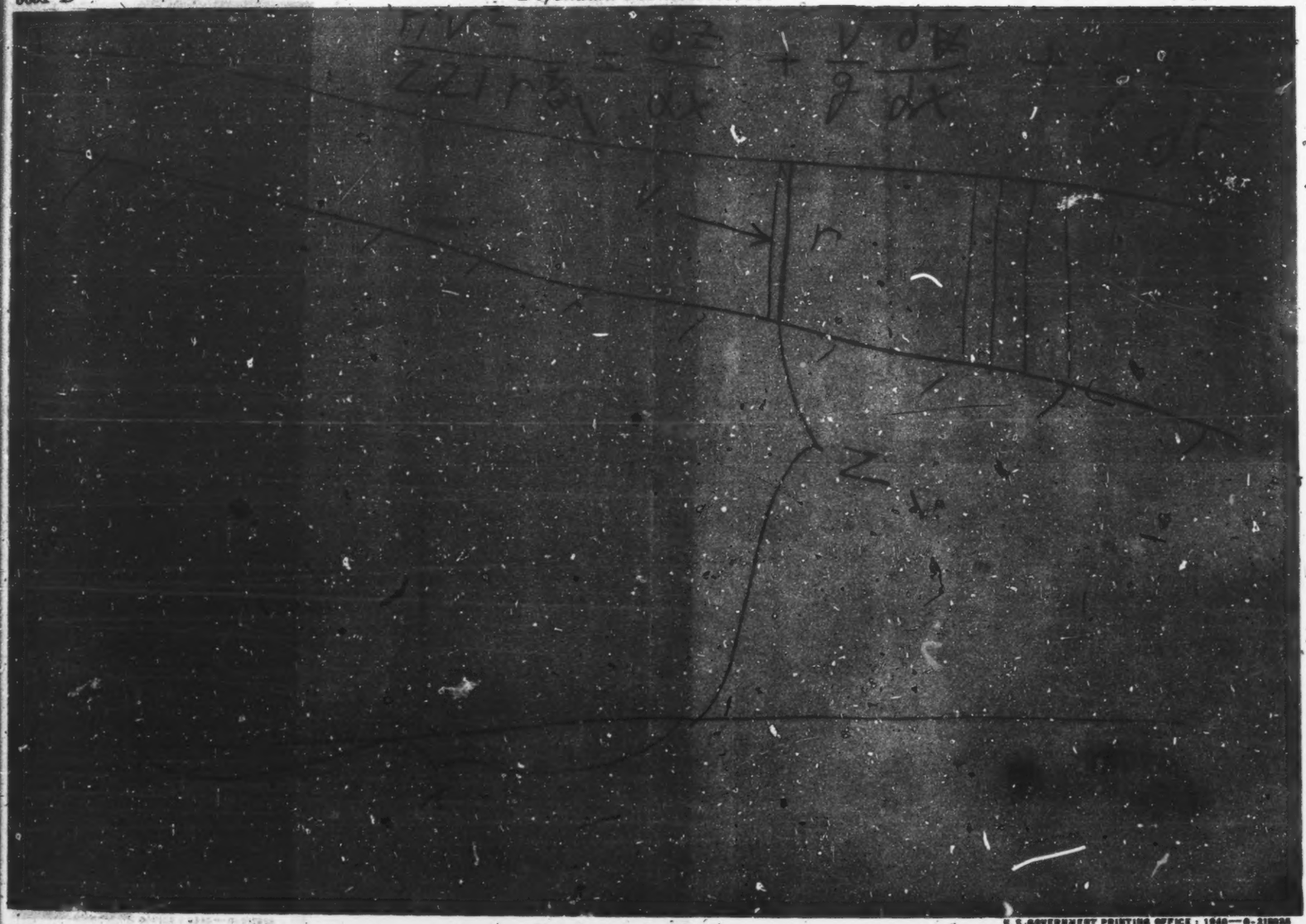
U.S. GOVERNMENT PRINTING OFFICE : 1940—O-215935

*Defendant's exhibit No. 596*




U. S. GOVERNMENT PRINTING OFFICE : 1949—0-219938

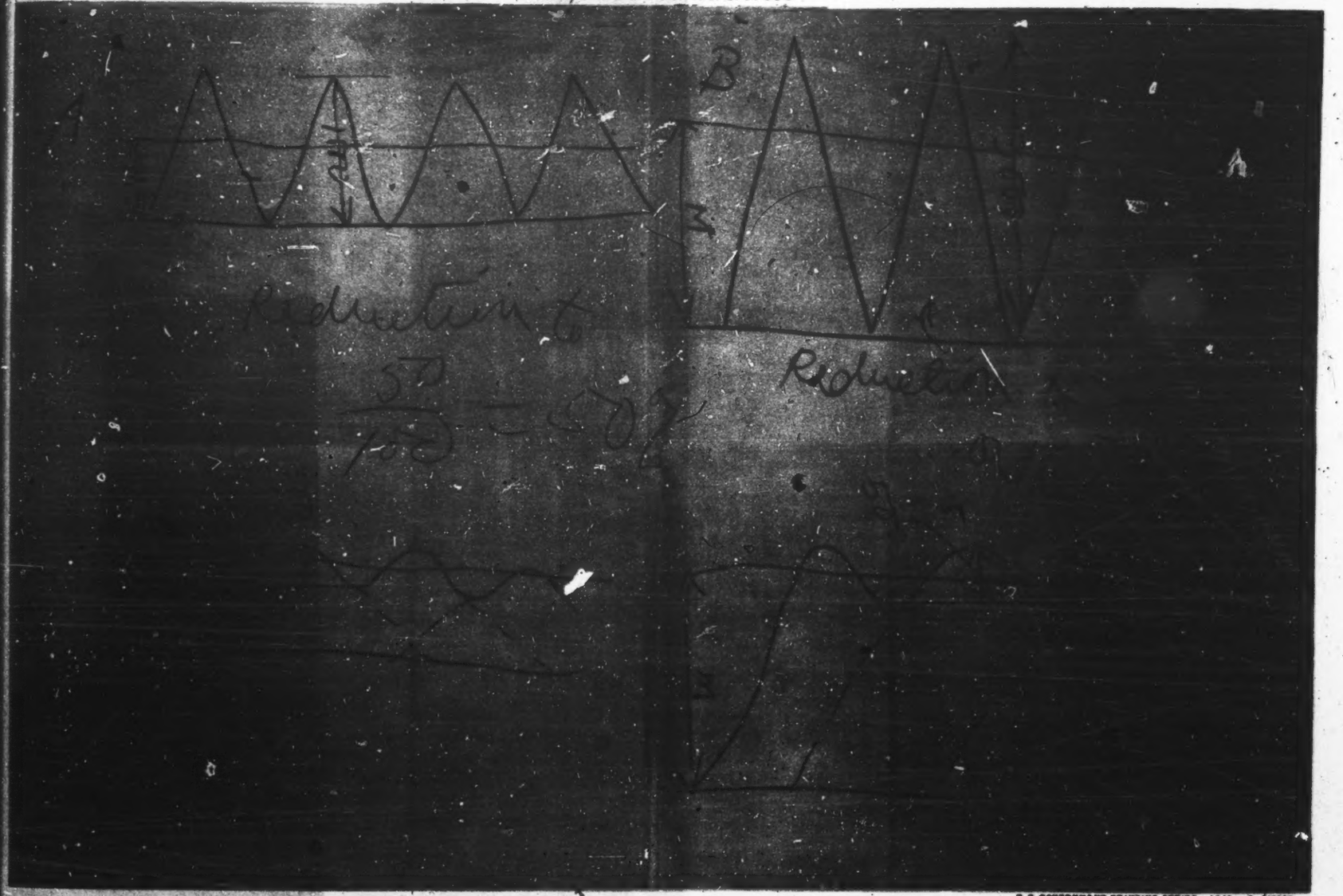
*Defendant's exhibit No. 597*




U. S. GOVERNMENT PRINTING OFFICE : 1940—O-218036

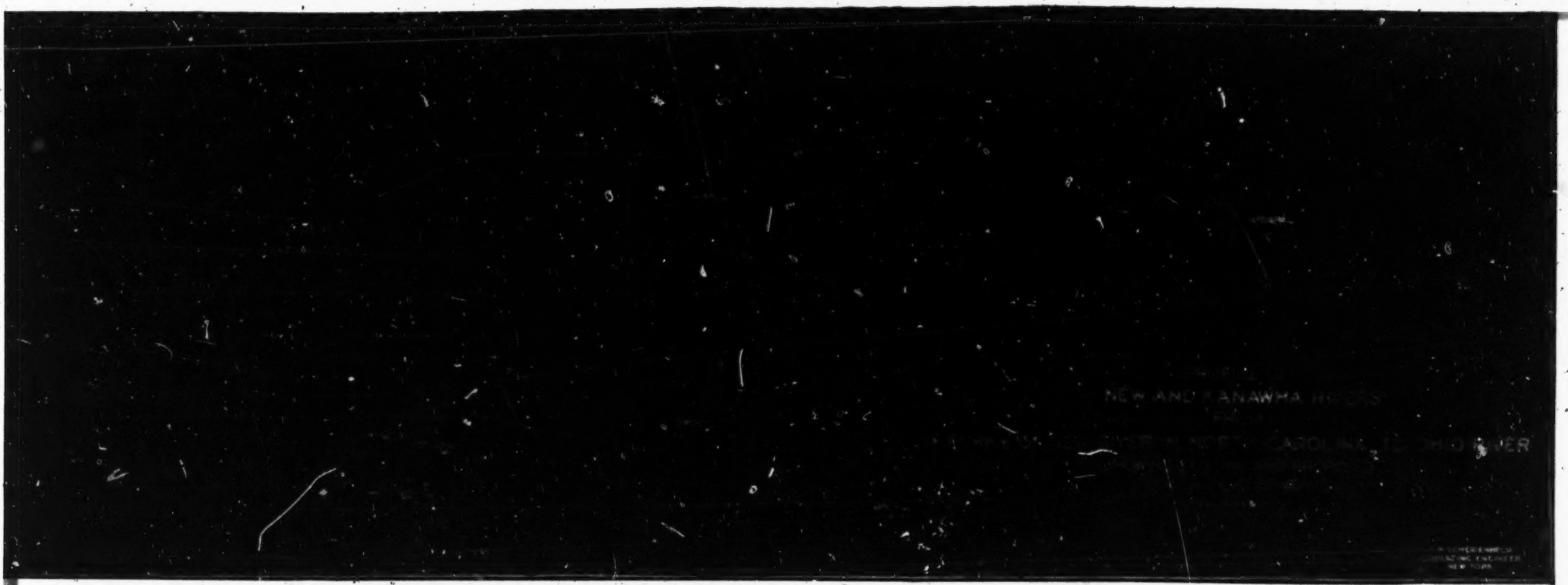
2651-C

*Defendant's exhibit No. 598*




U. S. GOVERNMENT PRINTING OFFICE : 1949—O-219035

*Defendant's exhibit No. 600*



U. S. GOVERNMENT PRINTING OFFICE : 1940—0-218030

*Defendant's exhibit No. 606*

Letter dated June 26, 1936, from Hon. John Paul to Secretary of War. (Original Exhibit.) (Printed as part of motion at fol. 100, supra.)

*Defendant's exhibit No. 607*

Letter dated July 17, 1936, to the Hon. John Paul, from Mr. Woodring, Acting Sec. of War. (Original Exhibit.) (Printed as part of motion at fol. 101, supra.)

3655 *Defendant's exhibit No. 608*

Letter dated June 26, 1936, from Col. Conklin, Addressed to the Kanawha Valley Power Company. (Exhibit 608 is the same as Exhibit 263 which is printed at fol. 3576-A herein.)

3655-A *Defendant's exhibit No. 609*

COL. SCHEIDENHELM

JULY 10, 1936.

Kanawha River Pool Fluctuations Resulting From Operation of the Marmet and London Hydro Plants

U. S. DISTRICT ENGINEER OFFICE,
*The Chesapeake and Ohio Railway Company Building,*
*Huntington, West Virginia.*

GENTLEMEN: Your letter of the 26th inst. on the above subject addressed to this company at Charleston, W. Va., attention of our Mr. Gould Ellis, has been referred to this office.

We are informed by Messrs. Ellis and McCormack that they did not understand that the conference held at your office on June 23, as referred to in your letter, was for the purpose of reaching any formal agreement, nor were they authorized to enter into such. Rather it was their intention to confer, in a co-operative spirit, to the end of solving the problems arising as to the relationship of the operation of the Marmet and London hydro stations to the needs of navigation.

We are impressed that in that respect the conference accomplished the intended purpose. At any rate Mr. Ellis, as Superintendent of System Operation of Appalachian Electric Power Company has proposed that tentatively the method of operating our two hydro stations be made to accord with the procedure as set forth in the latter portion of your letter. In

this proposal we have acquiesced and it is our understanding that it has been put into effect.

We shall be glad to learn the effect of such procedure, both upon the needs of navigation and upon the needs of the power system, and we assure you that all concerned in behalf of this company will be instructed to consider sympathetically, and to cooperate as far as reasonable in making further modifications should the need arise.

We fully appreciate the fact that the operation of the power stations is subject to the paramount condition that, where the real needs of navigation conflict with the needs of the power system, the latter must be subordinated to the former. Nevertheless, we trust we will not be misunderstood if we ask
3655–B that our acquiescence for the time being in the proposed operating procedure shall not be construed as agreement upon our part with regard to the correctness of all of the series of propositions set forth initially in your letter.

With regard to the proposed operating procedure, please note that, although such procedure is tentatively being put into effect, it appears to us that the limitation of the rate of draw-down in the London pool to one-half foot per hour is hardly reasonable under all of the circumstances. Even assuming for the moment that it were absolutely necessary from the standpoint of navigation, and in particular velocity conditions, that the rate of variation in water level at the lower (lock) gage at London should be limited to the above rate, it seems clear that no such consideration is involved in the case of rate of variation of water level in the London pool. On the other hand, the fixed power station capacity at London automatically imposes a limit such that, without any flow into London pool from upstream, even the lowest foot of the three feet of available pondage could not be drawn down within an hour.

At this time we have no specific proposal to make in that respect, but simply ask that with us you observe the effects of this tentative operating procedure to the end that possibly in this particular respect and perhaps others modification can be accomplished favorable to power development and without impairment to navigation.

Very truly yours,

KANAWHA VALLEY POWER COMPANY,
GRAHAM CLAYTOR, *Vice President.*

GC/G.

3655-C *Defendant's exhibit No. 610*

Letter dated July 28, 1936, from the War Department, United States Engineer Office, Huntingdon, W. Va., addressed to Col. F. W. Scheidenhelm, and signed by John F. Conklin, Lt. Col., Corps of Engineers, District Engineer. (Original Exhibit.)

3655-D *Defendant's exhibit No. 611*

Executive Order No. 6251, dated August 19, 1933. (Said Exhibit is set forth in full at fol. 2900 hereof.)

End of all evidence. (Clerk's Memorandum): And which, by order of Court entered February 24, 1939, is certified and approved as all of the evidence constituting the record on appeal in this case. See fol. 234 of the record for this order.

3656 *Memorandum required by rule 14, section 7, of the rules of the Circuit Court of Appeals for the Fourth Circuit*

I, C. E. Gentry, Clerk of the United States District Court for the Western District of Virginia, at Roanoke, Virginia, certify as follows:

1. Petition for appeal, filed July 29, 1938.
2. Order allowing appeal was signed, entered and filed July 29, 1938.
3. Citation issued and service thereof accepted by counsel for defendant on July 29, 1938.
4. Order entered July 29, 1938, extending time for filing transcript of record on appeal in Circuit Court of Appeals to November 10, 1938.
5. Order entered September 15, 1938, further extending time for filing transcript of record on appeal to Circuit Court of Appeals to December 15, 1938.
6. Notice of lodgment of statement of evidence served November 17, 1938.
7. Order entered November 30, 1938, enlarging time for filing appellee's amendments to the statement of evidence to January 10, 1939, and for filing record on appeal in the Circuit Court of Appeals to January 25, 1939.
8. Order entered on the 21st of December, 1938, enlarging time for filing appellee's amendments to the statement of evidence to February 1, 1939, and for filing transcript of record on appeal in the Circuit Court of Appeals to February 15, 1939.
9. Order entered February 2, 1939, extending time for filing transcript of record on appeal in the Circuit Court of Appeals to March 1, 1939.

10. Order entered February 25, 1939, extending time for filing transcript of record on appeal in the Circuit Court of Appeals to March 15, 1939.

Given under my hand this 13th day of March, 1939.

[SEAL] C. E. GENTRY,
*Clerk, U. S. District Court*
*for the Western District of Virginia.*

3657 [Clerk's certificate to foregoing transcript omitted in printing.]

3658 In the United States Circuit Court of Appeals for the Fourth Circuit

No. 4460

UNITED STATES OF AMERICA, APPELLANT

*vs.*

APPALACHIAN ELECTRIC POWER COMPANY, A CORPORATION, APPELLEE

Appeal from the District Court of the United States for the Western District of Virginia, at Roanoke

*Docket entries*

March 14, 1939, the transcript of the record is filed and the cause docketed.

Same day, the original petition for appeal, order allowing appeal, and citation are certified up.

Same day, the original exhibits are certified up.

Same day, the original documents called for in items a, b, c, d, and e of the praecipe are sent up.

Same day, two orders extending the time for the filing of the transcript of the record are filed.

Same day, three certified copies of orders extending the time for the filing of the transcript of record are filed.

Same day, order permitting appellant to file a main brief of not exceeding 100 pages and a reply brief of not exceeding 50 pages, and appellee to file a brief of 100 pages, is filed.

*Appearances*

March 18, 1939, the appearance of John L. Abbot is entered for the appellee.

March 20, 1939, the appearance of Joseph H. Chitwood, U. S. Attorney, David W. Robinson, Jr., Willard W. Gatchell, and Gregory Hankin is entered for the appellant.

3659 March 28, 1939, the appearance of Raymond T. Jackson, M. F. Milliken, A. Henry Mosle, Creswell M. Micou, Fraser M. Horn, Wendell W. Forbes, and M. W. Belcher, Jr. is entered for the appellee.

April 28, 1939, the appearance of John W. Aiken, Special Assistant to the Attorney General, is entered for the appellant.

May 9, 1939, motion of appellant for leave to file a supplemental brief and to file only 12 copies of volumes III, IV, V, and VI of appendix to brief, filed.

May 10, 25 copies of volumes I and II, and 12 copies of volumes III, IV, V, and VI of appendix to appellant's brief are filed.

May 16, 1939, order permitting appellant to file a supplemental brief in addition to main brief, and to file 12 copies of volumes III, IV, V, and VI of appendix to brief is filed.

May 26, 1939, joint motion for allowance of additional time for oral argument is filed.

May 29, 1939, order giving three hours to each side for the oral argument is filed.

May 31, 1939, motion of appellee for leave to file a supplement brief is filed.

June 2, 1939, order granting appellee leave to file a supplemental or reference brief is filed.

June 13, 1939, 25 copies of volumes A and B, and 8 copies of volume C of appendix to appellee's brief are filed.

June 16, 1939, motion of appellee for leave to dispense with the filing of more than three copies of volume C of its appendix filed.

3660 June 16, 1939, order permitting appellee to file three copies only of lume C of appendix to its brief is filed.

July 20, 1939, motion of appellee for order fixing time for service of appellant's reply brief, if any, is filed.

July 24, 1939, memorandum of appellant in opposition to motion of appellee for order fixing time for service of appellant's reply brief is filed.

July 27, 1939, order fixing time for filing of appellant's reply brief is filed.

August 8, 1939, motion of Clarence W. Meadows, Attorney General of the State of West Virginia, for leave to file brief and make oral argument on behalf of the State of West Virginia, as amicus curiae is filed.

August 8, 1939, order granting leave to Clarence W. Meadows, Attorney General of the State of West Virginia, to file brief and to make oral argument on behalf of the State of West Virginia, as amicus curiae, is filed.

August 18, 1939, 25 copies of volume VII of Appendix to brie of appellant are filed.

August 28, 1939, motion of Abram P. Staples, Attorney Gener of the Commonwealth of Virginia, for leave to file brief on behal of the Commonwealth of Virginia, as amicus curiae, is filed.

August 28, 1939, order granting leave to Abraham P. Staple Attorney General of the Commonwealth of Virginia to file brie on behalf of the Commonwealth of Virginia, as amicus curiae, i filed.

*Argument of cause*

August 28, 1939 (June term, 1939), cause came on to be hear before Parker and Northcott, Circuit Judges, and Chesnut, Di trict Judge, and is argued by counsel and submitted.

3661 In United States Circuit Court of Appeals, Fourth Circui

No. 4460

UNITED STATES OF AMERICA, APPELLANT

*vs.*

APPALACHIAN ELECTRIC POWER COMPANY, A CORPORATION, APPELLE

Appeal from the District Court of the United States for the Western District of Virginia, at Roanoke

Argued August 28, 1939. Decided November 6, 1939

Before PARKER and NORTHCOTT, Circuit Judges, and CHESNUT, District Judge

John W. Aiken, Special Assistant to the Attorney General; David W. Robinson, Jr., General Counsel, and Gregory Hankin, Special Counsel, Federal Power Commission, (Richard J. Connor, Assistant General Counsel; Willard W. Gatchell, Principal At torney, and Howard E. Wahrenbrock, Senior Attorney, Federal Power Commission, on brief) for Appellant, and Raymond
3662 T. Jackson, Wendell W. Forbes, and John L. Abbot (M. F. Millikan, A. Henry Mosle, Creswell M. Micou, Fraser M. Horn, and M. W. Belcher, Jr., on brief, for Appellee; Clarence W. Meadows, Attorney General of West Virginia, as amicus curiae, and Abram P. Staples, Attorney General of Virginia, as amicus curiae, on brief.

*Opinion*

Filed November 6, 1939

CHESNUT, District Judge:

The question for decision is whether the Appalachian Electric Power Company, a Virginia corporation (the defendant below and the appellee here) should be enjoined from the construction of a hydroelectric power dam in the New River at Radford, Virginia. To obtain this injunction the United States filed its complaint on May 6, 1935, in the District Court of the United States for the Western District of Virginia, in which it charged that the erection of the dam would be in violation of ss. 9 and 10 of the Rivers and Harbors Act of 1899 (33 U. S. C., ss. 401, 403), and also contrary to the provisions of ss. 4 (d) and 23 of the Federal Water Power Act of 1920 (16 U. S. C., 791–823), which was amended August 26, 1935, 49 Stat. 838.

Section 9 of the Rivers and Harbors Act provides in part that—

"It shall not be lawful to construct or commence the construction of any bridge, dam, dike, or causeway over or in any port, roadstead, haven, harbor, canal, navigable river, or other navigable water of the United States until the consent of Congress to the building of such structure shall have been obtained and until the plans for the same shall have been submitted to and approved by the Chief of Engineers and by the Secretary of War."

And Section 10 provides in part that—

"The creation of any obstruction not affirmatively
3663 authorized by Congress, to the navigable capacity of any of the waters of the United States is hereby prohibited;".

Under this statute it was necessary to obtain an Act of Congress to authorize the construction of a hydro-electric power dam in a navigable water of the United States, but by the Federal Water Power Act of June 10, 1920 (41 Stat. 1077; 16 U. S. C., Ch. 12, ss. 791–823) Congress created an administrative commission with authority to issue licenses to construct, operate and maintain "dams, water conduits, reservoirs, power houses, transmission lines, or other project works necessary or convenien for the development and improvement of navigation, and for the development, transmission and utilization of power across, along, over or in any of the navigable waters of the United States", such licenses (s. 803) to contain certain specified conditions, some relating to matters affecting navigation and others of an eco-

nomic and financial nature; and with the further proviso that the Commission in its discretion might waive any of the conditions except the license period of 50 years, if the license was "for a minor-part only of a complete project." Under the original Act of 1920, the Commission was composed of the Secretaries of War, Interior and Agriculture; but by amendment of June 23, 1930 (46 Stat. 797) the personnel of the Commission was changed to five commissioners appointed by the President by and with the advice and consent of the Senate.

Upon procedure provided for in the Act, the Commission approved the construction of the dam at Radford in accordance with the plans and specifications therefor which had been approved by the Chief of Engineers and by the Secretary of War with respect to navigation, and formally tendered to the Appalachian Electric Power Company, a so-called "major" license containing all the conditions enumerated in section 10 of the Act (16 U. S. C., s. 803). The Company expressed its willingness to accept the license with all proper regulations affecting navigation but requested the Commission to waive other condi-
3664 tions not affecting navigation, particularly those which related to the regulation of rates to be charged for electric power, the setting aside thereout of amortization reserves, and the so-called "recapture clause" giving to the United States the right to take over the project at the expiration of the license period of fifty years upon the basis of original cost less amortization reserves. Among its objections to these latter conditions the Company made the point that the Commission was without constitutional authority to prescribe conditions other than those affecting navigation. The Commission refused to waive any of the conditions of the major-part license; and thereupon the Company, having acquired all riparian and overflowage rights and specific and full authority from the State of Virginia, proceeded toward the erection of the dam without obtaining a license from the Commission. The injunction suit followed.

In its complaint the Government took the position that the New River throughout its whole course constituted navigable waters of the United States, and therefore the dam could not be constructed without permission from Congress or a license from the Commission; and further, that the construction and operation of the dam would necessarily be an obstruction to the navigable capacity of waters of the United States; and in any event was prohibited by the Federal Water Power Act unless licensed by the Commission. The answer of the defendant controverted all three of these propositions.

Proceedings before this suit: The proceedings before the Commission ran over a period of several years. Section 23 of the

ederal Water Power Act of 1920 provided that persons intend-
g to construct a dam in a stream "other than those defined in
is chapter as navigable waters, and over which Congress has
risdiction under its authority to regulate commerce between
foreign nations and among the several States, may in their
365 discretion file a declaration of such intention with the
Commission", and if after investigation the Commission
hould find that the interests of interstate or foreign commerce
ould not be affected, permission was granted for the construc-
ion; otherwise not without a license granted by the Commission.
he original project for the Radford Dam was initiated by a
redecessor of the Appalachian Electric Power Company, the
ew River Development Company, which filed its declaration of
ntention with the Commission on June 25, 1925, after first ob-
aining an opinion from Engineers of the War Department that
he river was not navigable, and therefore in its view not subject
o the jurisdiction of the Commission. The declaration stated
mong other things that "the proposed project will be so con-
tructed and operated so as not to impair the navigable capacity
f the stream below, nor to affect the interests of interstate or
oreign commerce". Thereupon the Commission requested a re-
ort on the declaration from the Chief of Engineers of the War
Department, Gen. Harry Taylor. His report of August 20, 1925
was to the effect that no sufficient reason was seen why the Com-
mission should not exercise jurisdiction over the proposed project
ecause while there was no present navigation on the river there
had been some on parts of the river in the past and the Govern-
ment had done work on certain parts of the river to improve
navigability; and the water-flow from the dam if not properly
regulated could have an adverse effect on navigation during low
water stages in the Kanawha River; but that such possible ad-
verse effect was not such as to warrant refusal to permit the
construction of the dam if control was maintained by the United
States. On October 24, 1925 the declarant wrote to the Commis-
sion requesting re-consideration by Gen. Taylor of his report and
submitting additional data relating to New River, which he said
had not been considered in his original report. Thereafter Gen-
eral Taylor re-considered the matter and rendered a second
3066 report to the Commission on December 29, 1925, in which
he said:

"A careful study has been made of all the data presented by the declarant and a further study has been made of all available data and records bearing on the question at issue which are available in this office, or which could be obtained from other government bureaus. The following report is the result of the addi-

tional studies which have been made and the additional information which has been obtained since the date of my original report."

In conclusion he stated:

"I therefore, report that in my opinion New River in its present condition is not a navigable stream and that navigation on the Kanawha River will not be adversely affected by the proposed power development."

On March 2, 1926 the Power Commission held a hearing on the declaration of intention as to the building of the power dam. The only evidence then submitted was the second report of Gen. Taylor, but there was argument by counsel for the Company and by the Attorney General of Virginia who appeared in opposition to the assumption of jurisdiction over the project by the Federal Power Commission. On April 17, 1926 the Commission transmitted to Gen. Taylor certain data with respect to the Pitt River in California which was considered as having a bearing on the question of the effect upon navigation on the Kanawha River by variations in the discharge of water from the Radford Dam, and requested his opinion thereon. On July 23, 1926 Gen. Deakyne, Acting Chief of Engineers, replied that the data with regard to the stream flow of the Pitt and Sacramento Rivers in California afforded no reliable comparison for New River by reason of different conditions, and that the correct procedure would be to study the action of waves in New River produced by discharges from dams then operating on the river. He
3667 referred to a very exceptional dry summer of 1925 and suggested the possibility that exceptionally dry seasons may occasionally occur during which the Radford Dam if unregulated might adversely affect the navigable capacity of the Kanawha River.[15]

The declaration which had been filed by the New River Company was assigned to and adopted by the Appalachian Company with the consent of the Commission on August 30, 1926, and on September 2, 1926 the Appalachian Company filed an application for a license on the Commission's suggestion that it would expedite matters and could be withdrawn if it later developed that no federal license would be required. Pursuant to custom the District Engineer of the War Department gave public notice for a hearing at Radford on October 28, 1926, but no evidence was then introduced. Thereafter the District Engineer made a report on December 22, 1926 favorable to the issuance of the

[15] The experiments suggested by Gen. Deakyne subsequently made on New River were discussed in the opinion of the district judge.

cense. On June 1, 1927 the Commission made a finding that he New River "is not 'navigable waters' within the definition hereof in said Act," but that the interests of interstate and oreign commerce would be affected by such proposed construc- ion. It was not stated in what respect interestate commerce ould be affected by the dam; but it appears that the Commission ad reference to the effect on navigability of the Kanawha River; nd the action of the Commission in that regard seems to have een based principally on its consideration of the data regard- ng the California rivers. On July 1, 1927 the Commission ered a full "major" license to the Appalachian Company. n April 26, 1928 the Company wrote the Commission that it as willing to accept all conditions reasonably designed to pro- ect the navigability of the waters of the United States, and to e controlled by any reasonable rules and regulations which the ecretary of War might prescribe in the interests of naviga- tion, but that unless the Commission could issue a license, 668 the conditions of which related solely to navigation, the Company would proceed with the construction of its dam ithout obtaining a license from the Commission. The letter lso requested reference of certain questions of law to the Attorney eneral of the United States. This request was not acted on at he time; and on February 4, 1930 the Company again wrote he Commission asserting its position that its project as operated ould not affect navigable waters and therefore was not within he jurisdiction of the Commission and asking reconsideration f the subject, but nevertheless suggesting that if the Commis- ion still asserted jurisdiction the Company would be willing to ccept a so-called "minor-part" license containing only such con- itions as would protect the interests of the United States in avigation. The letter enclosed a memorandum or brief in sup- ort of the authority of the Commission to grant such a license. n July 21, 1930 the Commission requested the opinion of the ttorney General of the United States as to its authority to issue so-called minor-part license, and in formulating the question tated that "New River is neither navigated or navigable in fact." n September 22, 1930 Attorney General Mitchell in an extended pinion advised the Commission that it could properly do so. He said:

"This interpretation appears necessary in order to avoid serious questions regarding the constitutionality of the Act which might be presented if section 10 (i) should be interpreted so as to have no application to projects constructed in or on non-navigable streams, which only remotely and indirectly affect the navigability

of waters in the lower reaches of streams to which they are tributaries." [16]

On October 6, 1930 the Appalachian Company requested action on its application for a minor-part license and submitted revised maps and plans for the project on October 16, 1930. On
3669 October 31, 1930 the Commission forwarded to the Company a draft of a minor-part license and on November 6, 1930 a revised draft of the same. This omitted the objectionable conditions as to rates, amortization reserves and recapture. The Company replied that the form was satisfactory and that if license was tendered it would at once begin construction work. In the meantime the draft of minor-part license had been submitted to the Acting Chief Counsel for the Commission who submitted a memorandum disapproving its issuance because it was not sufficiently shown that the Company had complied with the laws of Virginia and in his opinion it did not adequately protect the interests of the United States; and that the previous finding of the Commission that the river was not navigable waters of the United States was incorrect and should be reversed. The memorandum of counsel was submitted to the Chief Engineer of the Commission who replied in an extended memorandum not agreeing with the views expressed, and the Commission then resubmitted the question of navigability of the river to the then Acting Chief Engineer of the War Department, Gen. Brown, enclosing the memorandum of the Acting Chief Counsel of the Commission, and that of its Chief Engineer. Gen Grown replied that after reviewing the data there was no reason for changing the previous report of his office dated December 29, 1925, saying "it is my opinion that New River is not navigable at any point in its course." On October 18, 1930 Major Herman, the District Engineer for New River, had submitted a report in reference to a particular inquiry as to the navigability of New River at certain points in which he concluded: "It is the District Engineer's opinion, therefore, that New River is not navigable in fact either at Jackson's Ferry or Glenlyn, or at any other point in its course." On October 24, 1930, Col. Spaulding, the Division Engineer for New River, expressed his full concurrence with Major Herman's opinion. The Company submitted to the Commission an official letter from the Governor of Virginia
3670 stating that the Company had complied with Virginia laws for the construction of the project.

On November 25, 1930, at a meeting of the Commission, consideration was given to the issuance of the minor-part license and "after due consideration the Commission declined to take

[16] Section 10 (1) related to issuance of minor-part licenses.

action on the application, favorable or adverse. It was concluded that in view of the importance of the questions of jurisdiction as between the United States and the State of Virginia involved in this case a court adjudication is desirable." At the Commission's meeting on January 26, 1931 (the personnel of the Commission having changed pursuant to the amendment of the Act above referred to) the subject was again brought up and, in view of "the extreme importance of the legal questions involved" the Commission determined to hold another public hearing, notice for which was given for February 16, 1931. At that hearing attorneys for the Company and for several States submitted arguments and briefs respecting the interpretation of the Power Act, and the constitutional power of the federal government with regard thereto, and the authority of the Commission to issue a minor-part license. No evidence was introduced. On April 3, 1931 the Commission filed an opinion and order denying the application for a minor-part license, and directing that the Appalachian Company be tendered a standard form license under the Act, and ordering that it should not proceed with construction without such license. A minority of the Commission then favored a reversal of the former finding that the river was not navigable waters, but the majority were of the opinion that that question was one for the courts; that any finding of the Commission in that respect would not be binding upon the courts; and that the jurisdiction of the Commission was properly based upon section 23 of the Power Act above referred to.

Thereafter on June 8, 1931 the Appalachian Company filed suit in the United States District Court for the Western Dis-
3671 trict of Virginia against the individual members of the Commission to remove a cloud on the title to their land and to restrain the defendants from interfering with the Company's use of its property. The case was dismissed by the District Judge on the legal insufficiency of the complaint, but on appeal to this court the case was dismissed for lack of personal jurisdiction over the defendants. Appalachian Electric Power Co. v. Smith, et al., 67 F. 2d. 451, 458. While the case was pending in the District Court the Commission on October 12, 1932 adopted a resolution which, after referring to the pending case and the contentions of counsel therein as to the navigability of the New River, and the findings and action of the Commission with respect thereto, stated—"The Commission finds and declares that New River, from the mouth of Wilson Creek, Virginia, north, is navigable waters within the definition thereof, as set forth in section 3 of the Federal Water Power Act." This last action of the Commission was not taken after notice or hearing additional evidence.

The issues in the present suit: The Appalachian Electric Power Company began construction work on the dam about June 1, 1934. The bill of complaint in this case was filed May 6, 1935 to enjoin construction of the dam, averring that "New River is a navigable interstate stream arising in North Carolina and flowing in a northerly and northwesterly direction across the State of Virginia, into West Virginia, to the junction of Gauley River and New River, from which point it becomes known as the Kanawha River"; that the dam would constitute an obstruction to navigation and its construction was in violation of the two Acts of Congress above mentioned. The answer of the defendant denied these contentions. The principal and controlling issues presented by the pleading are therefore (1) whether the New River at Radford, Virginia, constitutes navigable waters of the United States; (2) if not, whether the construction and maintenance of the dam will naturally and
3672 necessarily obstruct or substantially impair the navigability of any other navigable waters of the United States and particularly those of the Kanawha River into which New River flows, or the Ohio River, into which the Kanawha flows; and (3) if neither of these facts is found, whether the defendant's actions are in violation of the Federal Power Act. There are some subordinate or incidental issues of law involved in these major propositions, one of which is the contention that the Commission's declaration of October 12, 1932, constituted a finding of fact that the New River is navigable; was based on substantial evidence, and therefore was conclusive in the case. There is also the contention by the Appalachian Company that there is no constitutional basis for the economic and financial conditions of the so-called major license contained in the Power Act as they do not in any way relate to navigation.

There was a lengthy trial of six weeks or more in the district court and a very voluminous record has resulted.[17] Much testimony was introduced regarding the physical characteristics of New River throughout its course and in particular stretches; concerning its history from its original discovery late in the seventeenth century; its use or lack of use for navigation during its history; the roadways and railroads touching it; the produce or commerce of the neighboring country; the natural and usual or normal methods of operation of a hydro-electric dam; the possible or probable or intended method of operation of the particular Radford Dam; and the effect, if any, that the discharge or lack of discharge of water therefrom would have upon the

[17] The printed matter submitted for our consideration on this appeal, including briefs, extends over 3,642 pages.

lower stream. The greater part of the extensive testimony was given before and orally heard by the district judge, and there was also a large amount of documentary evidence relating to the history and physical characteristics of the river, and re-
3673 ports of engineers of the War Department with respect to conditions found during the brief period of expenditure of government funds on strictly localized portions of the river, and proceedings before the Power Commission. The evidence also contains very numerous exhibits including many photographs of the river at various points, and maps and plats.

After the trial and consideration of briefs of counsel, the district judge filed an extended opinion reported in 23 F. S. 83, in which he discussed the issues of law and fact and separately made specific findings of fact and conclusions of law. On the controlling facts he found— .

"13. The New River is not a navigable water of the United States, either at the site of defendant's project or elsewhere throughout its course. The site of defendant's project is approximately 152 miles above the mouth of New River and approximately 160 miles above the head of navigation on the Kanawha River.

"15. The construction of the defendant's project will not obstruct the navigable capacity of the Kanawha River or of any navigable water of the United States. And the operation of defendant's project in any normal, rational, or probable method of operation will not obstruct or impair the navigable capacity of the Kanawha or any navigable water of the United States and will not affect the interests of interstate commerce."

On issues of law he determined that the New River is not a navigable water of the United States; that findings made by the Power Commission are not final, but in each case are subject to the determination of the courts; that the proper construction of the Power Act did not vest in the Commission the authority to require a license for a project in a non-navigable stream; that even if the Commission had power to require some license for a power dam in non-navigable waters of the United States, it could not validly impose therein conditions having no relation to navigable capacity of any navigable water of the United
3674 States; and that its action in seeking to impose upon the defendant the full major-part license in this case without constitutional authority to do so, bars its right to the relief prayed for; and that the bill of complaint should be dismissed as without equity. By the decree of May 10, 1938 the bill was dismissed, but the opinion concluded:

"By that it is, of course, not meant to hold that all rights of the United States to complain of this project are forever barred. If at any time in the future the project should be operated in such manner as to interfere with the navigable capacity of the Kanawha or any other navigable water (a contingency which appears most improbable), the United States will not be barred from asserting its right to protect this navigable capacity by compelling a removel of the structure or such modification of its operation as is necessary. But I am convinced that the evidence in this case does not disclose grounds for the issuance of an injunction at this time and the prayer for an injunction will be denied and the bill dismissed."

As the facts in this case were determined by the court without a jury, we are guided in our consideration of the findings of fact made by the District Judge by Rule 52 of the new federal rules of civil procedure, which provides:

"52. In all actions tried upon the facts without a jury, the court shall find the facts specially and state separately its conclusions of law thereon and direct the entry of appropriate judgment. * * * Findings of fact shall not be set aside unless clearly erroneous, and due regard shall be given to the opportunity of the trial court to judge of the credibility of the witnesses."

The new rule has been recently applied here in Guilford Const. Co. v. Biggs, 102 F. 2d. 46, where, in an opinion by Judge Parker, it was said:

"The provisions of the new procedural rules that the findings of fact of the trial judge are to be accepted on appeal unless clearly wrong (Rule 52 (a) 28 U. S. C. following section 723c) is but the formulation of a rule long recognized and applied by courts of equity. Adamson v. Gilliland, 242 U. S. 350, 37 S. Ct. 169, 61 L. Ed. 356; Deuster v. Marlboro Shirt Co., 4 Cir. 81 F. 2d. 139, 142; Sherman v. Bramham, 4 Cir. 78 F. 2d. 443; Miller v. Pyrites Co., 4 Cir. 71 F. 2d. 804; Suburban Imp. Co. v. Scott Lumber Co., 4 Cir. 67 F. 2d. 335; 90 A. L. R. 330."

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This rule seems to have special application in a case such as this where the trial has been exceedingly lengthy, very many witnesses have been heard orally by the district judge, and the subject matter so largely concerns a prominent geographical feature of his own district. Nevertheless in view of the importance of the case, involving as it does conflicting contentions as to state and federal power, and an important policy making act of Congress, as well as individual property rights, we have felt it particularly necessary to carefully review the evidence in the case

on which the findings of the District Judge are based. The States of Virginia and West Virginia have separately filed briefs in this case as amici curiae taking the position that the New River both in Virginia and West Virginia does not constitute navigable waters of the United States, and that the Federal Power Commission is without jurisdiction over the river.

In considering the effect and weight of the factual evidence regarding the New River, it will be helpful to first state the well established law with respect to rivers and streams, both intrastate and interstate, and whether navigable or not, and the riparian rights thereon respectively. In this case, which so directly involves state and federal rights, it is important to steadily keep in mind our constitutional distribution of power between the state and federal governments. The title to the beds of navigable waters within a state are vested in the State unless under its laws they belong to the riparian owners. (Borax Cons. Ltd. v. Los Angeles, 296 U. S. 10; Appleby v. New York, 271 U. S. 364; Port of Seattle v. Oregon & W. R. R., 255
3676 U. S. 56, 63; Arkansas v. Tennessee, 246 U. S. 158; United States v. Cress, 243 U. S. 316; Pumpelly v. Green Bay Co., 13 Wall. 166), and "the right of the United States in navigable waters within the several States is limited to the control thereof for purposes of navigation". Port of Seattle v. Oregon & W. R. R. Co., 255 U. S. 56, 63; United States v. Oregon, 295 U. S. 1, 14; James v. Dravo Contracting Co., 302 U. S. 134, 140. The federal government has no property rights in navigable streams or in the waters thereof. Its only power with respect thereto flows from the interstate commerce clause of the Constitution, a necessary incident of which is the power to control and protect navigation on navigable interstate rivers and other bodies of water. Gibbons v. Ogden, 9 Wheat. 1. Within the proper scope of the interstate commerce power, the control of navigation by the federal government is plenary; but its sphere of operation is necessarily limited to the protection of commerce which is interstate; the control over purely intrastate rivers and streams, as such, remains with the states, whether the waters are navigable or not; and it necessarily follows even an interstate stream which is not in fact navigable for purpose of interstate commerce is not subject to the control of the federal government, except to the extent necessary to protect other navigable waters. Federal legislation with respect to navigable waters is permissible only when it has some real and substantial relation to the control of navigation. United States v. River Rouge, 269 U. S. 411, 419; Port of Seattle v. Oregon, 255 U. S. 56, 63; Wisconsin v. Illinois, 278 U. S. 367, 415. For instance, Congress has no authority

to construct a hydro-electric dam primarily and only for the development and sale of water power. Ashwander v. Tennessee Valley Authority, 297 U. S. 288, 333; Alabama Power Co. v. Gulf Power Co., 283 F. 606, 613; Little Falls Fibre Co. v. Fo & Son, 249 N. Y. 495, 507, affirmed 280 U. S. 369.

3677 Where interstate waters are capable of promoting interstate commerce to a substantial degree, they are said to be waters of the United States, a classic definition of which is given in The Daniel Ball, 10 Wall. 557, as follows:

"Those rivers must be regarded as public navigable rivers in law which are navigable in fact. And they are navigable in fact when they are used, or are susceptible of being used, in their ordinary condition, as highways for commerce, over which trade and travel are or may be conducted in the customary modes of trade and travel on water. And they constitute navigable waters of the United States within the meaning of the Acts of Congress in contradistinction from the navigable waters of the States, when they form in their ordinary condition by themselves, or by uniting with other waters, a continued highway over which commerce is or may be carried on with other States or foreign countries in the customary modes in which such commerce is conducted by water."

The rule of this case has not been since departed from, but has been interpreted and applied in many different factual situations, as a result of which it is now held that an interstate stream is navigable in fact only when it is so used or susceptible of being used in its natural and ordinary condition, (United States v. Oregon, 295 U. S. 1; United States v. Utah, 283 U. S. 64, 76; United States v. Holt State Bank, 270 U. S. 49; Brewer-Elliott Oil & Gas Co. v. United States, 260 U. S. 77, 86); it must be capable of valuable public use in its natural condition, (United States v. Cress, 243 U. S. 316, 321); must have a capacity for useful interstate commerce of a substantial and permanent nature (Leovy v. United States, 177 U. S. 621), and must have a capacity for general and common usefulness for purposes of trade and commerce (United States v. Oregon, 295 U. S. 1, 23). Occasional or exceptional use under abnormal conditions is not sufficient (Oklahoma v. Texas, 258 U. S. 574, 591; United States v. Rio Grande Dam & Irrigation Co., 174 U. S. 690, 699); and as this court said in United States v. Doughton, 62 F. 2d. 93,

3678 quoting from Harrison v. Fite, 148 F. 781: "A theoretic or potential navigability, or one that is temporary, precarious and unprofitable, is not sufficient."

Is New River at Radford, Virginia, a navigable river of the United States? A very large part of the evidence relates to this issue. Apparently counsel have exhausted the available i

formation, documentary, historical and personal within living recollection. The whole evidence was reviewed and summarized and discussed at length in the opinion of the trial judge who reached the conclusion that the question must be answered in the negative, and our independent examination convinces us that he reached the right conclusion. The evidence is entirely too voluminous to review it in detail, but we will state the outstanding points which have convinced us that the dam is not located in navigable waters of the United States.

Physical characteristics of the river. A mere description of the physical and natural characteristics of the river is very persuasive that it is not susceptible of that character of navigation which is necessary, under the decisions above cited, to support the claim that it is navigable water of the United States. It is properly said to be sui generis, and is unlike many of the numerous rivers which have been described and held either navigable or nonnavigable in Supreme Court decisions which we have noted.[18] It is characteristically a mountain stream with steep gradient, relatively rapid current, and comparatively narrow stream bed, the river running in many places over
3679 limestone and sandstone, rocks and shale, the boulders frequently jutting above the surface of the water, with alternating comparatively still pools of varying length and numerous rapids, falls and shoals in many of which the depth of the water over the rocks is only about one foot, and frequently only a few inches. The following short general description is taken from a report by the Secretary of War to the House of Representatives in 1935 (74th Cong. House Document No. 31):

"Through almost its entire length the river flows through a rugged mountainous country. Its valley is narrow, the flood plain being very little wider than the low-water channel, which varies in width from about 200 to 1,000 feet. In many places the banks are sheer bluffs rising from the river's edge. Ledges of limestone, sandstone, and shale crossing the river at frequent intervals create rapids and waterfalls. The waterfalls vary in height up to about 18 feet. Between the ledges there are usually short pools of varying depth. The low-water depth in the channel varies from a few inches to more than six feet."

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[18] See The Montello, 20 Wall. 430, 443 (Fox River); United States v. Rio Grande, 174 U. S. 690, 709 (Rio Grande River); Leovy v. United States, 177 U. S. 621, 634 (Red Pass); Oklahoma v. Texas, 258 U. S. 574, 591 (Red River); United States v. Cress, 243 U. S. 316 (Cumberland & Kentucky Rivers); Economy Light Co. v. United States, 256 U. S. 113, 119 (Des Plaines River); United States v. Holt State Bank, 270 U. S. 49 (Mud Lake, Minn.), United States v. Utah, 283 U. S. 64 (Grand, Green, & Colo. Rivers); United States v. Oregon, 295 U. S. 1, 23 (Malheur & Harney Lakes, Ore.). But some comparison may be made with the Upper Columbia described in Mason Co. v. Tax Comm., 302 U. S. 190.

Among mountain streams it seems to be unique in the peculiar geologic formation of its rocky bed due to folds and faults in the rock strata, producing ledges running across the stream in many places. In a thirty-five mile stretch of the river in Giles County, Virginia, (an important section in this case, as is hereinafter particularly discussed) the geologic environment is "markedly unusual" in that it has been the scene of four predominant breaks or faults; and the slope or gradient of the rocks in the river bed is very unusual in that the incline "is downward in an upstream direction rather than in downstream direction", with the result that the water falls over the ledges almost vertically. Some of the ledges are upthrust above the surface of the water, and some are barely submerged, and this relative condition varies naturally with the depth of the water in alter-
3680 nate wet and dry periods. The difficulties and dangers of navigation caused thereby, both downstream and upstream, are obvious.[19]

New River rises in northwest North Carolina near the Virginia line and flows generally north-easterly through Virginia for 125 miles. After passing Radford, Virginia, it turns generally

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[19] The 35-mile section of the river referred to is a part of the 60-mile stretch between Radford, Virginia, the site of the dam in controversy, and the Virginia-West Virginia line. This section of the river is more fully described in the testimony of Prof. A. L. L. Mathews, a professor of geology who has specialized in stratigraphy. "New River is what we geologists call a young stream. That is, it has not yet completely adjusted itself to the geologic environment. It has not yet cut down through its length to such level that it has a low gradient or slope. It is still in the process of cutting down vertically through these rock strata. * * * From the standpoint of the geologist, the geologic environment of New River is markedly unusual. The region has been folded and faulted—that is, broken. At one time, millions of years ago, the rock strata now represented in the area were horizontal, but, due to the great earth forces exerted during the geologic ages, the rock strata were folded, twisted, and broken. So intensive has this warping and breaking of the rock been that various rock strata, which normally were at the bottom, so to speak, have been thrust up and over rock strata which ordinarily would lie uppermost. This particular area in New River has been the scene of four predominant breaks or faults. Perhaps the most unusual thing about the geologic condition in the region in point is the concentration of the folding or faulting within the relatively narrow area—that is, the distance from Glenlyn upstream to the south limit of Giles County. * * * As is frequently the case with faults, faulting in this area has resulted in the tilting of the rock strata, and, due to the concentration of the faultings, the strata are largely tilted to a very steep degree. In many cases they approach the vertical. * * * In its flow, the water of New River moves along and up the slopes of successive rock strata or ledges, and frequently falls over the upper or outcropping edges of these ledges. In many cases the falling over of out-cropping edges is practically sheer or perpendicular. * * * In other words, this results in a river with numerous ledges of rock strata, some partly submerged, some exposed, which are substantially vertical or standing on end, and which extend across the stream at right angles to the line of flow, this condition results in a stream with numerous submerged ledges, forming shoals, rapids, and falls. * * * Generally, the out-croppings of the resistant rock strata extend at right angles, across the stream. * * * the prevailing slope is downward in an upstream direction rather than in a downstream direction. * * * In the case of most streams flowing over sloping rock beds, the slope or dip is downward in a downstream direction. Here, however, the reverse is true."

northwestward and crosses the Virginia-West Virginia state line at a point about 160 miles below its head (the mouth of
3681 Wilson Creek), and then flows north about 25 miles to the City of Hinton in West Virginia, and thence northwesterly about 65 miles to Gauley, West Virginia where it unites with the Gauley River, and the two form the Kanawha River which continues in a northwesterly direction about 95 miles to Point Pleasant, West Virginia, where the Kanawha joins the Ohio River. The total distance from the head of the river at Wilson Creek to the Kanawha River is about 252 miles, and continuing to the Ohio River is 347 miles. Kanawha Falls, a precipitous rapid with a fall of 16 feet, is situated a mile or two below the junction of the New and Gauley Rivers, and the head of navigation on the Kanawha is a few miles below Kanawha Falls. The physical characteristics of the Kanawha are greatly different from New River, having a gradient of only 1.25 feet per mile as compared with the average gradient of the New River of 7.1 feet per mile. The Kanawha is admittedly navigable and has been fully "canalized" by the government which some years ago maintained ten navigation dams thereon, which have now been replaced in whole or in part by four new modern navigation and power dams of concrete construction. The gradient, slope or fall of the bed of New River is not uniform throughout its course but varies from three to four feet per mile to, at places, 31 feet per mile. The elevation above sea level at Wilson Creek is 2,240 feet and at Gauley, 651 feet; at the mouth of the Kanawha the elevation is about 500 feet. The stream velocity varies at the shoals and rapids from 3 to 5 miles per hour. The pools of comparatively still water vary in length from a few hundred yards to several miles with a probable average length of less than a mile. The rapids also vary in extent and in the degree of fall. Rapids of 2,000 feet are not uncommon and there are some of much longer extent. The low water depth in the channel varies from a few inches to more than 6 feet. After entering Virginia in Grayson County the river flows through and between spurs of the
3682 Blue Ridge Mountains, parallel to the main divides of the Blue Ridge and Alleghanies; and through almost its entire length at places through rugged mountainous country. The most steep, rough and rugged section of the river begins a few miles below Hinton and runs for approximately 45 miles in a narrow tortuous channel between high mountains where the river bed is a mass of sharp ledges and boulders and the water rushes with great velocity.

The average volume of flow of the river at Radford over a period of 28 years ending September 30, 1935, was 3,211 cubic feet per second; the lowest recorded flow there was 521 second-feet on

September 6, 1930 during the drought of that year. In the floods of 1878 and 1916 the flow was estimated at about 155,000 second-feet and 146,000 second-feet respectively. At Kanawha Falls, fifty-six year records show an average flow of 13,000 second-feet with a maximum of 270,000 in the flood of 1878 and a minimum of 640 second-feet on August 14, 1930.

The history of New River affords no satisfactory evidence of the early use of the river as a highway for trade or travel,[20] although the valley of the river would have made it a convenient highway through the mountains of Virginia toward the Ohio if the river had been navigable in fact. The river was discovered in 1671 by Col. Abram Woods, and there apparently were settlements in its valley by the middle of the eighteenth century. Early military expeditions toward the west apparently made no use of the river. Several exploratory trips on the river, or parts of it, were made in 1742, 1812, 1817, 1819 and 1828; but the reports thereof do not indicate that there was any navigation on the river. Some early Acts of Virginia and West Virginia have been referred to, relating to proposed opening or improvement of the river, or parts of it, for navigation, but nothing substantial seems to have been done under them. The earliest recorded use of the river for any form of transportation seems to have been during the Civil War when the Confederate Forces had a commissary depot some miles above the Virginia-West Virginia line and some supplies therefor were occasionally taken down the river in bateaux. There were a number of lead and iron mines situated on or near the river just above Radford, and there was coal in West Virginia. About 1872 some persons interested Congress in a plan for improving the New River for use in transportation between the two states. The implication would seem to be that the navigation of the river for this purpose did not then exist. In that year Congress authorized a survey of the New River which resulted in the so-called "mile by mile" survey which is, in our opinion, the most valuable evidence of the natural characteristics of the river.[21] Beginning in 1876 and running through 1882 Congress made various appropriations for work on the river. It was apparently contemplated that improvements should be made from Hinton up the river for 191 miles; but by reason of the very limited appropriation and the experience as to the cost of the work the engineers very soon decided that it would be impossible to create practical and con-

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[20] In this respect it is different from the history of the DesPlaines River found navigable in Economy Light Co. v. United States, 256 U. S. 113, and the Fox River in The Montello, 20 Wall. 431.

[21] See Government's Exhibit No. 31; and also the Moore and Briggs survey of 54 miles upstream from the Greenbrier in West Virginia. Government's Exhibit No. 32.

tinuous navigation through this entire distance, and they therefore concentrated their work on the stretch-up-stream from Hinton for about 25 miles, and up-stream from Radford for about 30 miles. The work as originally planned was divided into three sections of the river, one known as the lower or Greenbrier Division extending up-stream from Hinton; the Middle or New River Bridge Division, beginning about Radford, Virginia, and extending upstream to the lead mines in Wythe County, and the third section was known as the Upper or Lead Mines Division, from the lead mines toward the head of the
3684 river. No work was done on the Lower and Middle Divisions after 1882 and very little work thereafter was done on the Upper Division. In all about $112,000 was expended under various annual congressional appropriations. In 1891 Col. Craighill, who had been in general charge of the work throughout, reported to the Chief of Engineers of the War Department that the expenditure of a small balance of the appropriation for the work on the Upper Division would be a useless waste of public money. It is said by the plaintiff that this was the most difficult portion to improve. The most reliable evidence in the case in our opinion with regard to the conditions of the river, and the use or absence of use thereof for navigation, is to be found in the annual reports of the District Engineers in charge of the work. The whole is summarized in the report of Gen. Taylor, Chief of Engineers of the War Department, to the Federal Power Commission on December 29, 1925.[22] After correctly stating the substance of the applicable law as to navigable waters of the United States, and expressing the opinion that the natural condition of New River prior to the federal work did not show that it was navigable in fact, he continued:

"It is my opinion that these natural conditions were not changed by subsequent improvements, to the extent of making the river a highway for commerce."

Then after stating the limited amount of work accomplished in the three divisions separately he said:

"Work was limited to the most easily improved places and effort made to so ameliorate conditions as to permit local navigation. The results were not satisfactory or important and Congress discontinued appropriations after 1886, less than one-third of the funds required for any effective improvement having been provided. * * * It is evident that the work executed by the government during the years 1877 to 1882, did not mate-
3685 rially change the natural non-navigable conditions of the river. The improvement effected was at most slight and

[22] Defendant's Exhibit No. 572.

fragmentary, and the small channels worked over are reported to have deteriorated due to the natural action of ice and current. Continuous navigation on the river has never been possible, and whatever commerce has existed has been altogether local, apparently confined to the 25-mile section in West Virginia ending at Hinton.

"The District and Division Engineers have reported that there is no commerce and that the river is not now navigable in fact, but they assume that it is legally navigable for the reason that moneys have been expended on it for channel improvement by authority of Congress. It is well settled by judicial decisions that acts of Congress appropriating money for the improvement of a stream are not to be construed as declarations express or implied that the stream is actually navigable. Congress may authorize the improvement of a non-navigable stream with a view to creating navigability, yet unless the improvement is accomplished the natural state of the stream is not changed. Whether or not it is navigable is still a question of fact unaffected by the consideration that money has been appropriated and expended in an effort to improve it."

Opinions of War Department Engineers. The opinions of the Chief and District Engineers of the War Department familiar with the conditions on New River are entitled to much weight in this case. It is true that they are only opinions and are by no means conclusive; but they represent especially competent professional opinions on the subject matter with which they were necessarily well acquainted; and their opinions are disinterested. Reference has already been made to many opinions of different engineers touching the matter at different times, both long before the origin of the present case, and during its currency. Thus we have the deliberate opinion of Gen. Taylor in December 1925, after a full review of all the data then available in the War Department upon the subject, and we have his opinion later confirmed in 1930 by the then Chief of Engineers of the
3686 War Department, Gen. Brown, and also confirmed by Col. Tyler, Chief Engineer of the Federal Power Commission. Similar opinions have been expressed by District and Division Engineers on other occasions with regard to the river. It is very significant that the Commission found the report and opinion of Gen. Taylor a sufficient basis for its (first) finding of non-navigability.

Other evidence on navigability. It is not disputed that there is no appreciable use of the New River either intrastate or interstate for navigation at the present time, and there has been none for probably at least 25 years in the past. Probably the disappearance of all navigation of the river even locally in the vicinity

of Radford and Hinton was partly influenced by the coming of the railroads and the improvement of adjacent roadways. However that may be, at the present time the river is certainly not used and is useless for any substantial or valuable navigation, but by virtue of its physical characteristics is very valuable for water power purposes. A number of power dams have been erected on the river of which there are two a considerable distance above Radford (one about fifty miles) which were constructed without obtaining any authority from the federal government and which have never been interfered with by it. There are also many bridges across the river. The government itself has determined to erect a very large dam and reservoir without locks or other means for navigation, for the combined purpose of flood control and power development, in the river a few miles upstream from Hinton. Condemnation proceedings for this purpose are now pending and the government's position therein has been sustained by this court. United States v. West Virginia Power Co., 91 F. 2d. 611. It is also not without significance that the plans and specifications for the Radford dam (without provision for locks) have been approved by the War Department from the standpoint of navigation, and the Federal
3687 Power Commission in tendering a license to the defendant company therein recited its finding that the construction of the dam would not be an obstruction to navigation but properly operated would be an improvement thereof. In these circumstances it is apparent that navigation on New River between Radford and Hinton is not a matter of practical moment and the question of navigation is at the most only theoretical. United States v. Doughton, 62 F. 2d. 936. It seems to be an entirely logical inference that if the government has heretofore maintained that the river constitutes navigable waters of the United States between these points, that view must be considered to have been abandoned by it for all practical purposes. We are not unmindful that the Supreme Court in Economy Light & Power Co. v. United States, 256 U. S. 113, held that unauthorized artificial obstructions in an otherwise originally navigable river did not destroy its legal navigability; but there the court was dealing with a situation where the DesPlaines River had been in the past one of the principal highways of commerce, trade and travel to the west for more than a century; and the intervention of the government was under different circumstances from those here existing. The question of navigability is one of fact and each case must be determined on its own circumstances. In the present case the actions of the government in the respects just referred to at least are important evidentiary facts bearing

on the question whether there is now or ever has been navigability in fact of the New River.

The complaint in this case alleged that New River was navigable throughout its whole course from its source at or near the North Carolina-Virginia line through the states of Virginia and West Virginia; but this extensive claim has now been abandoned and the contention as to navigability is limited to the 115 mile stretch of the river from Allisonia in Virginia (about 30 miles up-stream from Radford) to Hinton in West Virginia. From Radford to the Virginia-West Virginia line the river is
3688 about 60 miles in length; and Hinton in West Virginia is 25 miles further down-stream. For the plaintiff to successfully maintain that New River at Radford, Virginia, constitutes navigable waters of the United States, it had the burden of proof to show that the river was a highway for substantial and permanent trade and travel of a generally useful and valuable nature between Radford and Hinton or other points in West Virginia. Upon consideration of voluminous evidence the district judge reached the conclusion that this had not been shown and our independent consideration of the evidence leads us to the same conclusion.

We have not failed to carefully consider the arguments of counsel for the plaintiff in opposition to this conclusion. It is said that the opinion of the district judge (contrary to his findings of fact) shows that the stretches of the river in the somewhat improved sections up-stream from Radford and Hinton respectively were navigable in fact, and it is contended that the physical characteristics of the river in the 60 mile stretch down-stream from Radford to the State line are such that it was susceptible of navigation equally with the improved sections before their improvement. We are not persuaded that this contention on the facts is established. The evidence of the defendant's photographs of places on this section of the river and the mile-by-mile survey above referred to show the serious obstacles to navigation in this stretch of the river consisting of several difficult falls, and many long rapids and shoals. And this stretch includes the 35 miles in Giles County having markedly unusual geologic formation of the rock strata of the river bed above mentioned. It is said there was an ample volume of water, and the gradient or slope of the river was on the average not much steeper than in the sections which were improved, and that the pools were much greater in extent than the rapids. But the obstacles to navigation consisted chiefly in the falls and
3689 rapids which were numerous and long; and the slope was not uniform, but very much greater than the average

in many places.[23] No federal work was done on this 60 mile section of the river between Radford and the State line with the exception of less than a mile in Virginia which had no important significance in interstate navigation. As appears from their reports the engineers concentrated their limited available funds on the improvement of conditions around Radford and Hinton where there was access to railroads and where it would therefore be of some value locally. If this stretch of the river was not navigable in fact in its unimproved condition, it is not to be considered navigable merely because it might have been made navigable by improvements which were not in fact made. Of course if the improvements had been made the question of fact might have been different.

Much reliance is also placed by plaintiff's counsel of
3690 their contention that despite any obstacles to navigation in the 60 mile stretch between Radford and the state line, there was sufficient testimony of non-expert witnesses with regard to the use of bateaux or keelboats on the river to show that it was navigable in fact even in this critical stretch. It appears from the engineers' reports that there was some use of keelboats on the river as early as 1873; but the extent of their operation before the beginning of the government work in 1878 is not stated, and the annual reports during the government work indicate quite clearly that their use was local in the vicinity of Hinton and Radford respectively; and there is nothing in these reports to show navigation by keelboats between Radford and Hinton. Plaintiff's counsel say that this missing evidence is sup-

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[23] The mile-by-mile survey reached Radford coming down stream at about the fortieth mile. Thereafter for illustration some of the more difficult obstacles to navigation shown in the survey in various places reads as follows:

"49th mile. Rapids and shoals (mostly over bowlders) 2000 feet long; fall, 4 feet.

"51st mile. Rapid, over bowlders and gravel, 1500 feet long, fall, 8 feet.

"53rd mile. At lower end Barnitz Falls, over five ledges of limestone 450 feet, over all fall, 6 feet.

"54th mile. Shoal and rapid over bowlders and gravel 800 feet long, fall 4 feet.

"57th mile. Shoals continue for 1,600 feet; then a short pool and Walker's Mount Falls, where the river falls 5 feet in 500 feet, over two ledges of shale and metamorphic limestone.

"68th mile. Continuous ledges of 4,000 feet; fall 8 feet.

"74th mile. Snidow's Falls, 2,000 feet in length; over bowlders and gravel, fall, 3 feet.

"79th mile. Rapid over two ledges, 500 feet long; fall 7 feet; swift water whole mile.

"92nd mile. Peter's Mountain Falls, where river falls 4½ feet in 1,300 feet, over a succession of limestone ledges, terminating in an abrupt fall of 5 feet.

"100th mile. Neilley's Falls and rapids; whole fall 11 feet, 6 of it nearly vertical. A sluice 500 feet long, along left bank, will pass them, with 50 feet of rock excavation and 450 feet of bowlders and gravel.

"104th mile. Commences with shallow riffle, 600 feet long, over bowlders and gravel, and following this occurs Wiley's Falls where the river falls 4 feet in 10 feet, over a limestone ledge about 50 feet wide."

plied by a number of aged witnesses testifying from unaide memory as to their knowledge or observation of keelboats in th river fifty to sixty years ago. The district judge discussed a length the extent of the use of keelboats on the river and sum marized it as follows:

"It was in these separated stretches of the river that prac tically all of the bateaux navigation took place and only o them that there was any appreciable trade or commerce by boa *It is not meant to say that continuous movement of such boat between Hinton and the vicinity of Radford was impossible o did not occur.* There is evidence which indicates that it did oc cur, but there is a vagueness about the extent to which it oc curred and indications that *such trips were irregular, were at tended with difficulty and formed no appreciable part of an commercial transportation which took place on the river.* Th most definite evidence of the extent of navigation on the rive are the reports of the government engineers both before and afte beginning improvement of the river in 1877, and these report repeatedly state that the commercial navigation was local t separated stretches of a stream and that there was no continu ous navigation." [Italics supplied.]

3691 It is said that this conclusion did not correctly apprais the effect of the oral non-expert testimony; and in plain tiff's reply brief there are listed the names of 23 such witnesse from whose testimony it is contended the contrary conclusio should have been reached. We have carefully considered thi testimony, but are not convinced that it was given too littl weight. This is the type of testimony that the trial judge wh sees and hears the witnesses is particularly well qualified t appraise. These witnesses were for the most part elderly me who were testifying purely from unaided memory of events lon past. Such testimony has inherent infirmities and is obviously not entitled to the weight to be properly given to contemporary official written records (United States v. Oregon, 295 U. S. 19) It also had to be appraised in connection with similar testimony of almost an equal number of witnesses introduced by the de fendant by which it was to a considerable extent contradicted or qualified; and proper consideration also had to be given to th other testimony in the case, verbal and documentary, of exper and scientific witnesses tending very strongly to show that th river was non-navigable in fact. But even if the recollectio testimony of the witnesses on both sides is viewed as a whol apart from the other evidence, we do not think that it showe interstate navigability of the river within the requirements of th judicial decisions above mentioned. Very few of these 23 wit

nesses for the plaintiff (about four or five) testified to any personal experience in keelboat trips on the river between Radford and Hinton (and from parallel testimony by defendant's witnesses several of these were not ordinary commercial trips for trade or travel); more (six or seven) related recollection of their use between Hinton and Glenlyn (the latter in Virginia about 5 miles from the state line); and the others stated that they had seen or used keelboats on one or more occasions at various points on the river within the 60 mile stretch, and some of them
3692 had hearsay information that some of the boats went as far down stream as Hinton. Viewed as a whole, the testimony seems to us to establish nothing more than that there were some trips of keelboats between Radford and Hinton; that such trips could be made only at particular times when there was unusually high water; that even then navigation was not only difficult but also dangerous; that while the boats at times may have carried some country produce there was nothing like an established trade and commerce between Radford and points in West Virginia; and that the duration of such use of the keelboats was for a few years only and has been non-existent for more than 50 years. Very possibly this entire disappearance of any keelboats on the river was influenced somewhat by the coming of the railroads to Glenlyn in 1883 and to Allisonia in 1886; (there were railheads at Hinton in 1873, ar[illegible] Radford some years earlier); but there was also testimo[illegible] of non-expert witnesses submitted by the defendant to the effect that the attempt to commercially use keelboats was unsuccessful and unprofitable, and in the Radford-Allisonia district was substantially abandoned before the railroad came to Allisonia in 1886. We conclude that the summary of the testimony on this point above quoted from the opinion of the district judge is a fair appraisal of the evidence; and that the plaintiff has not shown that there was interstate navigation on New River of such a substantial and permanent n[illegible]ure, and of such general and common usefulness, that it would subject the river to federal servitude for the benefit of navigation.

We have also considered the weight to be properly given to the fact of the government work. In many cases such evidence may be a factor of great importance in favor of navigability; but in this case we do not think it conclusive or even very important, in view of its limited nature and abandonment. It was referred to in the reports as "experimental" and was finally abandoned as a further waste of money, on the Upper
3693 Division. It did not, according to the reports, essentially change the original non-navigable condition, and was lim-

ited to a few local stretches. In the circumstances it cannot properly be regarded as establishing navigability. Oklahoma v. Texas, 258 U. S. 574, 590.

Will the maintenance and operation of the dam obstruct the navigable capacity of any down stream navigable waters of the United States? Here again the testimony bearing on this issue is voluminous consisting largely of scientific and expert opinion. It also has been reviewed at length in the opinion of the district judge who concluded that the operation of the dam in any normal, usual and reasonable way would not substantially affect the down-stream navigability of the Kanawha or Ohio Rivers; and in our opinion the weight of the evidence bearing on this issue clearly supports the finding made. Of course the mere construction of the dam apart from its operation could have at the best only very temporary effect on the downstream flow of water pending the filling of the storage reservoir behind the dam. It is not the plaintiff's contention that the dam must necessarily be operated in such a way as to prejudice down stream navigability, because it is conceded in the briefs that the proper operation of the dam in accordance with the conditions of the proposed license and the rules and regulations of the Commission and the War Department would even be of benefit to navigation. The contention is that the size and capacity of the dam, in relation to the average volume of flow of the stream, is such that the only reasonable inference is that the dam will be operated in a way to impair down-stream navigability. It is pointed out that the plans for the dam provide for a draw down area of 27 feet with hydro-electric machinery of 104,000 h. p., and a capacity for water consumption of 9,000 cubic feet per second; and that the average annual flow of the New River at the point of the dam is only a little more than 3,000 cubic feet per second.
3694 The capacity of the reservoir or storage pool for water behind the dam is said to be 100,000 acre-feet. It is also pointed out that this hydro-electric dam is only one link in a large electric light and power generation and distribution system of the Appalachian Company whose public service extends interstate over a distance of 100 miles or more. From these facts it is argued that the cost of the dam could be economically justified only on the assumption that it would function in the whole system to furnish power at that time of the day and week when the power demand upon the Appalachian system is at its peak, or, as it is expressed, the dam will be operated on a "peak" basis; and it is further said that this means operation in which during about eight hours of the day five days a week the power machinery will be used to its full capacity of 9,000 cubic feet per second and will discharge that amount into the river below the dam,

while during the remaining hours of the day for five days a week, and probably all of Saturday and Sunday, there will be no operation of the dam for the generation of electricity, and no discharge of water into the river below the dam. The ultimate deductions made in the argument are that in the low water seasons the consumption and discharge of water will be cut off entirely until the reservoir is filled, thus depriving the Kanawha and Ohio Rivers of a material part of their water supply from New River; and when the dam is operated the alternate shutting down of the plant with no discharge of water and the release of water during the hours of operation at the rate of 9,000 cubic feet per second will cause "power waves" which will have an adverse effect upon navigation in the Kanawha by causing there fluctuations or oscillations in the stream.

The defendant denies the reasonableness of these assumptions as to the method of operation of the power dam, and very definitely says that it has no intention to so operate it, and that the assumed method would be abnormal and impracticable.
3695 It explains that the large maximum capacity for the use of 9,000 cubic feet per second flow is not designed to be used currently, but only as a potential reserve for temporary emergencies. The defendant realizes that by customary day by day operations it cannot use more than the average amount of the water flow, simply because the water will not be there to use; and therefore it must proportion its actual operations to the stream flow, occasionally drawing on the reservoir for the continuance of customary and usual operation, when the water flow in dry periods is abnormally low. The defendant does not deny that in its intended customary daily operation there will be a variable amount of water discharged from the dam, but it does deny that there will be such great variations as are assumed by the plaintiff; and it denies that the variable amount will have any adverse effect on down stream navigability. The defendant's stated position is that it fully realizes that it has no property right in the water as such, and is only entitled to a reasonable use thereof as riparian owner, which must be limited in such way that the rights of other riparian owners on the stream below and above will not be prejudiced. It points out that it will have a very large monetary investment in its project and that it would be economically very unwise and indeed foolish to operate its plant in such a way that the rights of others would be impaired and the defendant subjected to damages therefor; or to operate the plant so that it would be subject to a successful injunction suit for impairment of navigable capacity of downstream waters.

There is no reason to doubt the good faith of the defendant in its position so stated because it expressed its willingness to accept the minor-part license from the Commission containing, among other things, the condition that it as licensee should be liable for all damages occasioned by the operation of the project; and the condition that "whenever the flow at lock No. 2, Kanawha River, falls below 1400 second feet, the Licensee
3696 shall when so directed by the Secretary of War discharge in each 24 hours the natural flow of the river at the dam site during that period up to a discharge of 1150 acre feet. The discharge from the project shall at all times be regulated by such rules and regulations as the Secretary of War may prescribe to prevent undue interference with navigation on the Kanawha River."

The evidence of expert witnesses offered by the plaintiff on this issue was largely based on their assumptions as to the defendant's probable operation of the dam. The contentions in substance are that for considerable periods of time there would be no discharge of water from the dam in consequence of which the volume of water flow in the Kanawha and Ohio Rivers would be seriously diminished; and the discharge of water from the dam when made would be in such large quantities as to form block waves of 9,000 cubic feet per second which would cause much increased velocity of current in the Kanawha and fluctuations and oscillations of the water level which would impair its navigability. These contentions are refuted in the testimony of a number of witnesses for the defendant who were competent and experienced engineers in the construction and operation of hydro-electric plants. In this connection it is to be noted that the distance on the river from the Radford Dam to the head of navigation in the Kanawha is approximately 160 miles on a tortuous river coarse interspersed with numerous rugged ledges; and there is a recently constructed power dam at Hawks Nest on the New River a few miles up-stream from the Kanawha [24] which would naturally absorb any "power waves" from the Radford plant that remained after their 150 mile journey from Radford. In addition the government has recently constructed three large navigation and power dams on the Kanawha River known as the London, Marmet & Winfield Dams, with another now under con-
struction at Gallipolis, Ohio, equipped with locks for
3697 navigation, as a result of which the Kanawha River is fully "canalized", that is, consists of a series of pools between the dams affording approximately uniform depth of water for navigation. These dams also have large power capacity

[24] See United States v. West Virginia, 295 U. S. 463.

and are operated under lease from the government by private interests. They directly discharge water consumed by power operations into the respective pools. There is also evidence to the effect that there is an abundant supply of water from tributaries of the New River and Kanawha River below Radford to supply any loss or waste of water in the pools of the Kanawha caused by the operation of the locks or otherwise. The purpose of the navigation dams on the Kanawha is to maintain an approximately uniform level of water. In these circumstances the district judge found that it was highly improbable that any operation of the Radford Dam would or could impair the navigability of the Kanawha and Ohio Rivers.

There is still another factor to be considered in this connection, relating to the government's project for the Bluestone Dam in the New River without locks, approximately 150 feet high. The dead storage will rise about 66 feet, with 49 additional feet of useable draft water, leaving 35 feet to be reserved for freshets and flood control. The storage capacity is to be 245,000 acre-feet, about two and one-half times greater than the Radford Dam (85 miles up-stream), and the Bluestone Dam is to have a maximum hydraulic capacity of about 11,000 cubic feet per second. The primary purpose of this dam is for flood control with incidental power production. It seems quite evident that this Bluestone flood control project will remove any possibility of any impairment of navigable capacity of the Kanawha from the operation of the Radford Dam if the latter were otherwise possible.

It will also be recalled that in his report of December 29, 1925 to the Power Commission, Gen. Taylor, then Chief Engineer of the War Department, after reviewing the data upon the subject, said:

3698 "Therefore, so far as can be predicted from available data and records it would not be possible to operate the proposed project so as to adversely affect navigation on the Kanawha River under the existing project.

"I, therefore, report that in my opinion New River in its present condition is not a navigable stream and that navigation on the Kanawha River will not be adversely affected by the proposed power development."

The Commission apparently rejected Gen. Taylor's opinion as to the effect on the Kanawha River, although it does not clearly appear what other evidence it had before it on the subject, except possibly the report as to the effect of waves from power dams on certain California rivers (which was determined to be inadmissible in the district court for lack of proof as to similarity of conditions).

On this and other evidence too detailed to elaborate here, the district judge found that there would be no reasonable likelihood of adverse effect on the navigability of the Kanawha or other navigable waters of the United States; and we find no sufficient reason in the case to conclude that he was wrong in this finding. On this issue the plaintiff had the burden of proof to establish its contention that the operation of the Radford Dam would affect the navigable capacity of down-stream navigable waters. The leading case on this point is United States v. Rio Grande Dam & Irrigation Co., 174 U. S. 690. The suit there was to enjoin the defendant company from constructing a dam across the Rio Grande River in New Mexico at a point where the river was not navigable, but it was alleged the maintenance of the dam would impair the capacity of the down-stream river where it was navigable. The government's case was based on section 10 of the Rivers and Harbors Act of September 19, 1890 (later somewhat amended by the 1899 Act on which this present suit is based). The Supreme Court said:

"Of course, when such proceedings are instituted it 3699 becomes a question of fact whether the act sought to be . . enjoined is one which fairly and directly tends to obstruct (that is, interfere with or diminish) the navigable capacity of a stream. It does not follow that the courts would be justified in sustaining any proceeding by the Attorney General to restrain any appropriation of the upper waters of a navigable stream. The question always is one of fact, whether such appropriation substantially interferes with the navigable capacity within the limits where navigation is a recognized fact."

The plaintiff was not entitled to the injunction in this case unless it established an existing or presently threatened impairment of navigable capacity of the Kanawha; and where the defendant in such a case evidently in good faith denies any intention to commit an injury, the plaintiff must show that the injury sought to be avoided by the injunction will be necessarily or practically certain, and not merely the probable, result of the acts whether intended or not. Connecticut v. Massachusetts, 282 U. S. 660, 674; Missouri v. Illinois, 180 U. S. 208, 248; Blease v. Transit Co., 4 Cir. 50 F. 2d. 852, 856; Mayer v. Somerville Water Co., 82 N. J. Eq. 572; Pennsylvania v. Sun Co., 290 Pa. 404, 413.

The plaintiff also contends that even if there would be no impairment of the navigable capacity of the Kanawha, nevertheless it is entitled to the injunction because there will be an impairment of interstate navigation between Glenlyn on the New River in Virginia, and Hinton in West Virginia. We are not impressed by this contention. Glenlyn is about five miles up-

stream from the Virginia-West Virginia line. In 1912 it had a population of only 500. The railroad along the river reached Glenlyn in 1883. There is no present navigation of the river between Glenlyn and Hinton and there has been none for probably 25 years. It is said that there was considerable keelboat navigation of the river between Glenlyn and Hinton in previous
3700 years; but we are disposed to believe from the evidence that this is an overstatement. There are serious obstacles to navigation on the river between Glenlyn and the state line, including Shumate's Falls and Wylie's Falls at or near the state line. Probably any substantial transportation on the river in earlier times was from Round Bottom, below these difficult rapids, to Hinton. The federal improvement work never reached upstream to Glenlyn but stopped four or five miles below it. A light draft steamer built at Hinton was unable to get upstream more than about 15 miles. In 1930 the District Engineer of the War Department reported that the New River was not navigable at Glenlyn. In these circumstances, it would not be justifiable to issue an injunction to restrain an obstruction to the purely theoretical navigation of New River between Glenlyn and Hinton, especially where there is no satisfactory proof that the operation of the defendant's dam will in fact impair even possibly existing present capacity for navigation, and where there is no likelihood of future navigable use of the river. Of course if the defendant's dam is so operated in the future as to impair navigation, if any at that point, it may well be proper then for the courts to intervene. It is also again significant here that the government's Bluestone Dam will destroy any possibility of navigation from Glenlyn to Hinton.

There is also a contention by the plaintiff that the Radford Dam may in some way impair the efficiency of the Bluestone Dam for flood control, and thus operate prejudicially on navigation of the lower river. The district judge considered and rejected this contention as based on insufficient evidence, and we find no good reason to reach a contrary conclusion. It would seem the Radford Dam would be a help rather than a hindrance in this respect; and if not an injunction may later be appropriate.

The effect of the Federal Power Act on the case.
3701 While nearly all of the evidence related to the two issues above discussed, the major part of the legal argument in this case has revolved around the proper construction and application of the Federal Water Power Act of 1920, and as amended in 1935. It is contended by general and special counsel for the Power Commission that even if New River at Radford is not navigable waters of the United States, and the operation of the dam will have no adverse effect on the navigable capacity of

down-stream waters, nevertheless the defendant must be enjoined from constructing the dam because it has not obtained a license from the Power Commission. It is argued that the Power Act is an exercise by Congress of a much wider jurisdiction over streams than was asserted by the Rivers and Harbors Acts of 1890 and 1899; and that in the Power Act Congress has given the Commission jurisdiction to prevent, except by its license granted on the conditions specified by the Commission, the erection of any bridge, dam or other structure on rivers and streams, whether navigable or not, where the interests of interstate commerce are concerned, whether they relate to navigation or not. In connection with this view it is said in the briefs "Thus the primary purpose of the legislation was the control of water power development, not of navigation." This argument is based upon the language of section 23 of the Act of 1920. But before examining this contention we notice two preliminary points based on the Act.

In the first place, it is argued that in this proceeding the findings of the Commission with respect to navigability and the effect of the dam on navigability, and on interstate commerce, are conclusive if supported by substantial evidence, which is asserted to be the case here. It is not disputed that the case can be judicially considered de novo, but it is said that the ordinary rule that findings of an administrative tribunal must be accepted, if supported by substantial evidence, must control the decision here on the facts. In our view this contention is not ap-
3702 plicable to the present case. Section 23 does not provide for a "hearing" by the Commission when a declaration of intention to build a dam is filed, but only for an "investigation" by the Commission. Nor does the Act provide for any judicial review of the findings made. Nor is this case a statutory proceeding by way of appeal from or review of the Commission's action. Assuming that the finding of the Commission is a relevant fact for the consideration of the court, and that it is entitled to careful and respectful consideration as the opinion of a body informed by experience, nevertheless it cannot properly be regarded as controlling judicial determination on the record in the case. Clearly the decision of the district court involved a constitutional question of the jurisdiction of the Commission in relation to the distribution of state and federal power, and of riparian property rights of the defendant. This, we understand, is not disputed so far as the action of the district court was invoked under the Rivers and Harbors Act; and it seems equally clear that the same must be true with respect to any jurisdiction of the Commission in this case. In that view it is clear that the district judge was required to determine the question of fact de

novo on the record made at the trial before him. Crowell v. Benson, 285 U. S. 58, 59; St. Joseph's Stock Yards Co., v. United States, 298 U. S. 38, 51; B. and O. R. R. Co. v. United States, 298 U. S. 349, 364.

It is also suggested that the defendant is estopped to question the findings of the Commission because it submitted itself to the action of the Commission in requesting a finding that the Commission was without jurisdiction and in applying for a minor-part license; but we do not think this view is tenable as the United States has in no way been prejudiced thereby, and the defendant throughout has clearly enough stated its legal position to the effect that the Commission did not have jurisdiction. There can be no proper waiver of constitutional rights in such a situation; nor do we think it was the intention of
3703 Congress that there should be; Buck v. Kuykendall, 267 U. S. 307, 316, 317; Ashwander v. T. V. A., 297 U. S. 288; nor do we think that Standard Oil Co. v. United States, 283 U. S. 235 (cited by the plaintiff), relating to the election of remedies under the Interstate Commerce Act by a shipper, is applicable here.

If the public hearing granted by the Commission in 1926 and above referred to is to be regarded as a hearing in the sense of due process, and therefore the defendant is to be affected by the finding of the Commission that the interests of interstate commerce would be affected by the dam, we could hardly conclude that the finding was based on substantial evidence, in view of the fact that the only evidence then introduced was the report the opinion of Gen. Taylor to the contrary. At the hearing counsel for the defendant inquired whether further or other evidence was to be considered by the Commission and if so, indicated his desire to be informed of it. Nothing was then said to indicate that the Commission desired or would consider other evidence. It is now said by counsel for the Commission that it did have available, and must have considered other information upon the subject to be found in various official reports, public documents, and Acts of Congress, many of which were offered in evidence by the plaintiff in this case.[25] But as these matters were not brought to the attention of the Company at the hearing, it is not perceived how they could be regarded as evidence affecting it in the sense of due process. Interstate Commerce Commission v. Louisville & Nashville Railroad Co., 227 U. S. 88, 91; Morgan v. United States, 304 U. S. 1, 14, 15, 19. For the

[25] It is also pointed out that the Commission had 21 affidavits filed by the Dam Company tending to support non-navigability; and certain protests filed by individuals. These do not seem to affect the matter.

same reasons we do not think that the subsequent declaration or finding of the Commission on October 12, 1932, can be regarded as in any way affecting the rights of the defendant, be-
3704 cause it was made ex parte without notice or hearing. It is not meant to suggest that the Commission at any time intentionally proceeded arbitrarily, or without proper regard to the rights of the Dam Company, or that its proceeding was inappropriate to the "investigation" directed by the Act; but only that its finding, to the extent based on information obtained informally and ex parte, and not brought out at the notified hearing where it would be subject to cross-examination and possible refutation, cannot properly be considered as consistent with due process, if sought to be made conclusive on the defendant. The reasonable assumption would seem to be that the procedure followed was adopted as appropriate to an "investigation" by the Commission, rather than a "hearing" with the legal implications thereof. See Norwegian Nitrogen Company v. United States, 288 U. S. 294, 317.

Attention is called to the definition of navigable waters contained in section 3 (16 U. S. C. s. 796) of the Water Power Act.[26] It is apparently not contended that the definition expands the scope of the term beyond the previous judicial decisions applying it under the Rivers and Harbors Act and in other cases (Alabama Power Co. v. Gulf Power Co., 283 F. 606, 614); but it is said that the statutory definition has crystallized the judicial definition on three points, of which one is said to be particularly applicable here—that is, that navigability should be determined in reference to the stream in its actual condition,
whether "natural or improved". The observation is then
3705 made that the district judge in his opinion apparently implied that the federal improvements on New River were not to be considered in determining its navigability. But we do not understand the opinion to proceed on that basis.

We come now to the Commission's present construction of section 23 of the Water Power Act of 1920 which reads:

"Projects not affecting navigable water; necessity for Federal license. Any person, association, corporation, State, or munici-

[26] " 'Navigable waters' means those parts of streams or other bodies of water over which Congress has jurisdiction under its authority to regulate commerce with foreign nations and among the several States, and which either in their natural or improved condition, notwithstanding interruptions between the navigable parts of such streams or waters by falls, shallows, or rapids compelling land carriage, are used or suitable for use for the transportation of persons or property in interstate or foreign commerce, including therein all such interrupting falls, shallows, or rapids; together with such other parts of streams as shall have been authorized by Congress for improvement by United States or shall have been recommended to Congress for such improvement after investigation under its authority."

pality intending to construct a dam or other project works across, along, over, or in any stream or part thereof, other than those defined in this chapter as navigable waters, and over which Congress has jurisdiction under its authority to regulate commerce between foreign nations and among the several States, may in their discretion file declaration of such intention with the commission, whereupon the commission shall cause immediate investigation of such proposed construction to be made, and if upon investigation it shall find that the interests of interstate or foreign commerce would be affected by such proposed construction, such person, association, corporation, State, or municipality shall not proceed with such construction until it shall have applied for and shall have received a license under the provisions of this chapter. If the commission shall not so find, and if no public lands or reservations are affected, permission is hereby granted to construct such dam or other project works in such stream in compliance with State laws."

We have italicized the clause on which the construction is based. The view contended for is that this clause, as a part of the whole section, gives the Commission jurisdiction over dams proposed to be constructed on nonnavigable waters, irrespective of the effect of the dam on navigable waters of the United States, whenever the Commission finds after investigation that "the interests of interstate or foreign commerce would be affected by such proposed construction;" that is to say, if the dam is to be constructed
3706 in a stream not a navigable water of the United States and will have no effect on navigation, nevertheless it may not be constructed without a license from the Commission if it will affect interstate commerce in some other way not related to navigation. Specific application of this construction is given to the instant case in the contention that although New River at Radford is found to be not navigable waters of the United States and the dam will not affect down-stream navigable capacity, nevertheless the Radford Dam may not be constructed without a license from the Commission because (1) the river at or above Radford has years heretofore been used for keelboat transportation of goods for delivery to the railroad at Radford for carriage in interstate commerce and might possibly be similarly used hereafter, and (2) the dam is intended to transmit electric power outside of Virginia. The construction flows from the general view of the purpose of the Act expressed by counsel for the Commission in their brief when they say: "Thus the primary purpose of the legislation was the control of water power development, not of navigation". We do not think this broad construction of the Act based on the interstate commerce power, to the

extent that it is dissociated from navigation, is tenable either on the basis of statutory construction or constitutional authority. Alabama Power Co. v. Gulf Power Co., 283 F. 606, 613.

As a matter of statutory construction. It will be noted that the section leaves it optional with the proponent of the project to apply to the Commission for a determination. On the plaintiff's construction we have therefore the following possible divergent results dependent upon whether the option is exercised or not. Where the option is not exercised and the Commission is not consulted (and therefore makes no finding as to interstate commerce) the remedy of the United States is to bring an injunction proceeding to abate the dam, in which event it will be necessary for the government to show either that the river is
3707 navigable water of the United States or the dam would affect navigable capacity. But in the event the project owner elects to consult the Commission upon the subject and it finds that interstate commerce would be affected in some way not related to navigation, then the government could successfully maintain the injunction suit on the basis of the Commission's finding alone without proof of the effect of the project on navigation.

But apart from this, a reading of the Water Power Act of 1920 as a whole indicates that it was intended to assert control (where federal property was not concerned) only where the interests of navigation, as an incident of interstate commerce, were affected.[27] (See New Jersey v. Sargent, 269 U. S. 328, 336). Prior to the Water Power Act we are not aware of a successful assertion of authority by Congress over non-navigable waters within a state, (not involving public property of the United States) except where the interests of interstate commerce flowing from navigation were concerned. This was the extent of authority indicated in the Rio Grande case, supra.[28] Over navigable waters of the United States Congress directly has juris-

[27] The title to the Act reads "An Act to create a Federal Power Commission; to provide for the improvement of navigation; the development of water power; the use of the public lands in relation thereto, and to repeal section 18 of the River and Harbor Appropriation Act, approved August 8, 1917, and for other purposes." Section 18 of the Act of 1917 (Ch. 49, 40 Stat. 269) repealed by the Water Power Act had created the Water Ways Commission to formulate plans to develop water resources for navigation, etc., and, among other things, to investigate "questions relating to the development, improvement, regulation, and *control of navigation as a part of interstate and foreign commerce*, including therein", etc. [Italic supplied.]

[28] It may be noted that that case arose under section 10 of the Rivers and Harbors Act of 1890 which prohibits "the creation of any obstruction, not affirmatively authorized by law, to the navigable capacity of *any waters in respect of which the United States has jurisdiction*." In the 1899 Act the wording was slightly changed to read "the creation of any obstruction not affirmatively authorized by Congress, to the navigable capacity of any of the *waters of the United States* is hereby prohibited." [Italic supplied.]

3708 diction to prevent obstructions to navigation; but over non-navigable waters within a state, where the riparian rights are not owned by the government itself, the only authority or jurisdiction of Congress flows from the interstate commerce power which, with respect to rivers and streams as such, is limited to the protection of navigation of other streams. Beyond this federal control over non-navigable streams is the same as, but no greater than, over state highways on land not usable in interstate transportation.

Section 4 (d) of the 1920 Act authorized the Commission to issue licenses for the purpose of constructing, operating and maintaining dams, etc.,

"necessary or convenient for the development and improvement of navigation, and for the development, transmission, and utilization of power across, along, from or in any of the navigable waters of the United States, or upon any part of the public lands and reservations of the United States (including Territories), or for the purpose of utilizing the surplus water or water power from any Government dam, except as herein provided: * * * Provided, further, that no license affecting the navigable capacity of any navigable waters of the United States shall be issued until the plans of the dam or other structure affecting navigation have been approved by the Chief of Engineers and the Secretary of War. Whenever the contemplated improvement is, in the judgment of the commission, desirable and justified in the public interest for the purpose of improving or developing a waterway or waterways for the use or benefit of interstate or foreign commerce, a finding to that effect shall be made by the commission and shall become a part of the records of the Commission." (Italics supplied).[29]

Section 11 provides for the inclusion of conditions to promote navigation where the dam is constructed "in any of the navigable waters of the United States." Section 18 provides for the 3709 operation of navigation facilities constructed in connection with licensed dams. Apart from section 23 the provisions of the Act, relating to the authority over the construction of power dams, seems to be clearly based on the interstate commerce power with respect to navigation. Section 23 was added as amendment 58 in the course of a long legislative history; and its wording and punctuation may be lacking in entire clarity, but it seems quite unlikely that in this merely permissive amendment it was the intention of Congress to confer on the Commission jurisdiction over streams in matters affecting interstate com-

[29] Some of the wording was changed by the 1935 amendment, and the section became 4 (e) of the new Act. See 49 Stat. 840; 16 U. S. C., s. 797 (e).

merce but not related to navigation, especially as Congress had not previously asserted such a power.

It is contended that the 1935 amendment to section 23 supports the construction contended for. The only change in the comparable part of the section was to make the filing of the declaration obligatory instead of optional. The wording of the clause on which the construction contended for is based was not changed. We do not attach the significance to the amendment that is claimed for it. Nor do we think it should be given a retroactive effect. It was passed after the institution of this suit and more than a year after the beginning of the construction of the dam.

The construction now put upon section 23 by counsel for the Commission seems to be much broader than that advanced in the district court. There it seems to have been limited to the contention that the Commission had jurisdiction over nonnavigable streams only where the proposed structure would affect the navigable capacity of the river down-stream, that is in this case the Kanawha. After extended consideration the district judge reached the conclusion that the effect of the section was only to provide a convenient method of determining, in advance of the construction of the dam, the status of a stream of doubtful navigability; and that the Commission had no jurisdiction over nonnavigable streams. The opinion referred at some length
3710 to the legislative history of the section when offered as amendment 58, and also to early expressions of the Commission shortly after its first organization, in support of that view. We take a partly different view of the effect of the section with respect to nonnavigable streams.

The wording of section 23 which requires application, rather than construction, is "any stream * * * over which Congress has jurisdiction under its authority to regulate commerce between foreign nations and among the several states". It is clear that the Commission is given authority by this section only over a stream "over which Congress has jurisdiction" under the interstate commerce power. We think this modifying clause has no uncertainty of meaning in view of the legal history of the subject matter. Over what streams does Congress have jurisdiction by virtue of the interstate commerce power? Ever since Gibbons v. Ogden and The Daniel Ball, supra, it has been clearly understood that Congress does have such jurisdiction over interstate navigable waters; and by section 10 of the Rivers and Harbors Act of 1890 (26 Stat. 454) this jurisdiction was logically and properly extended to nonnavigable rivers which were tributaries of navigable interstate rivers to the extent that "the creation of any obstruction, not affirmatively authorized by law, to

the navigable capacity of *any waters in respect of which the United States has jurisdiction*" is prohibited. In the 1899 Act (30 Stat. 1151) on the same subject the wording of the underscored phrase was slightly changed to read "the creation of any obstruction not affirmatively authorized by Congress, to the navigable capacity of *any of the waters of the United States* is hereby prohibited". [Italics supplied.] Section 9 of the Rivers and Harbors Act of 1899 also provided that dams and certain other structures should not be constructed in any "navigable river, or other navigable water of the United States" until the consent of Congress has been obtained and the plans approved by the Chief of Engineers and by the Secretary of War. It
3711 will thus be noted that prior to the Water Power Act of 1920 Congress had asserted jurisdiction over interstate navigable waters, and also over streams tributary thereto, to the extent mentioned, by prohibiting any structures in interstate navigable waters and in non-navigable tributaries, if the latter affected navigable capacity of interstate navigable waters, unless the consent of Congress was first obtained. One of the purposes of the Water Power Act was to authorize the Commission to license dams in navigable waters of the United States in lieu of an Act of Congress; and in our opinion one of the purposes of section 23, which was an amendment to the original Act, was to likewise take care of the case of a proposed structure in a non-navigable tributary of an interstate navigable stream. Before the Water Power Act it was not safe to construct a dam in a non-navigable stream, where there was any doubt whether navigable capacity of down-stream waters might be affected, without an Act of Congress; and section 23 was added to the Act to provide a convenient administrative procedure to determine this doubt from the standpoint of the government, so that the project owner would know the position of the government in the matter. If the Commission found that interstate commerce would not be affected in the respect mentioned, then the project owner was permitted by the section to proceed without a license; but if the Commission found otherwise, then the stated position of the government was that he could not proceed without a license and if he did so it was at the risk of being enjoined. But as the authority of the government to forbid the structure was necessarily dependent upon the fact that it would impair navigation, the government could succeed in the suit only on proof of that fact de novo, as it is a jurisdictional requisite to the power to control the use of private property without compensation.

In their briefs counsel for the Commission have now called to our attention certain earlier legislative history

3712 of the Act in support of their contention that the proper construction of section 23 was to give the Commission full jurisdiction with respect to both navigable and nonnavigable streams wherever any interests of interstate commerce would be affected; but we are not persuaded that this earlier history tends to support that view. The Water Power Act had a long and interesting legislative history in the course of which many amendments were proposed which reflected diverse views upon the subject, and we do not think it would be a safe basis for interpretation of the final form of section 23 to impress upon it argumentative inferences from numerous former amendments.

The broad construction of the section now contended for runs counter to established legal principles. Where the interests of navigation are not involved (and where the United States does not itself possess property rights) the control of the use of the flowing water and the rights therein of riparian owners are subject to the laws of the several states. In this case under the laws of Virginia the defendant Company has the full riparian rights of ownership including the right to the reasonable use of the waters flowing past its land for the development of power, and has a license from the State of Virginia to construct and operate the dam under its general Act for the development of water power resources of the State. If the river were federally navigable the rights of the riparian owners would of course be fully subject to the federal servitude in the interests of navigation; but the riparian owner on a non-navigable stream is entitled to reasonable use of the flowing waters (not impairing downstream navigable capacity) subject to no easement in favor of navigation; and this is a property right which cannot be taken from him without just compensation. United States v. Cress, 243 U. S. 316; Carpenter v. Gold, 88 Va. 551; United States v. River Rouge, 269 U. S. 411, 418; Lynchburg v. Mitchell, 114 Va.
3713 229; Holyoke Co. v. Lyman, 15 Wall. 505, 506. The power of Congress over interstate commerce is, of course, plenary, and private property may be taken for a public use in connection therewith; but only subject to the just compensation provided for in the 5th Amendment; and to prohibit the defendant company from the exercise of its riparian rights in the case, where no interests of navigation are involved, would seem to be a taking of private property without due process required by that Amendment. While Congress may impair the effectiveness of executory contracts which interfere with the exercise of the interstate commerce power, we are not aware of any authority which would justify the taking of private property without just compensation as an exercise of the regulation of commerce. Radio Comm. v. Nelson Bros., 289 U. S. 266, 282; Virginian Ry.

v. Federation, 300 U. S. 515, 558; Interstate Commerce Commission v. Oregon-Washington R. Co., 288 U. S. 15, 41; Monongahela Nav. Co. v. United States, 148 U. S. 312, 336.

We therefore cannot adopt the plaintiff's construction of section 23 that the Commission has jurisdiction over non-navigable streams under the interstate commerce clause irrespective of the interests of navigation. It is argued that if the river in the vicinity of Radford is locally navigable (even though not navigable interstate) and if goods can be carried on the river there to the railroad for further carriage in interstate commerce, then Congress has the power to regulate the river as an instrumentality of interstate commerce. As there is no such commerce on the river, and has been none for many years, with no likelihood of any in the future, the contention seems only theoretical. But apart from this the proposition is not sound in our opinion. We know of no authority to support it, and it runs counter to the established principles above stated. If the river is not navigable interstate, its control and use (except that down-stream navigability of other waters of the United States may not be impaired), is subject to the laws of the State, and not of
3714 the federal government. If it can be assumed that the suggested possibility of keelboat use of the river would be of sufficient importance to be worthy of regulation by Congress as a part of interstate commerce, and therefore the keelboats themselves and the rates charged by them, could be subjected to federal regulation as in the case of the railroads, it does not follow that the use of the river, which is subject to state laws and control, could likewise be so regulated. Congress could of course purchase or condemn the river or riparian rights thereon and convert it into a highway for or instrumentality of interstate commerce, but only upon payment of just compensation. To prohibit the use of the river for a dam or other purpose lawful under state laws, irrespective of navigation, would be taking property without compensation. The Daniel Ball, 10 Wall. 537, 562 (supra), is referred to in support of the plaintiff's contention, but we do not so read it. There a vessel was held subject to the navigation laws requiring a license, because she was operated on a navigable river of the United States within the definition then given and always since followed. It was held no defense that she did not herself ply interstate when her carriage was of goods destined for interstate transportation in connection with railroads. So here it may be assumed that Congress could validly require the keelboats to be licensed; but that is quite a different proposition from asserting federal control over state waters and denying the exercise of property rights thereon without compensation.

The construction now contended for by the Commission will obviously have a very important effect on the rights of the States of Virginia and West Virginia. Both states by their respective Attorneys General have filed briefs as amici curiae in opposition thereto. The question is of great importance to them because it is said that there are many non-navigable mountain streams in the two states which though useless for purposes of navigation are of great value in the development of hydro-electric
3715 power; and both states years ago legislated upon the subject of water power development.[30] The statutes of both states have provisions generally similar to the conditions in the federal statute with respect to rates and "recapture" at the end of a fifty-year license period. Both states contend that with respect to such matters they have full power and control as internal affairs of the state reserved to them under the 10th Amendment. Reduced to simplest form, the vital question is whether the states or the national government ultimately are entitled to become the owner of these hydro-electric power plants on nonnavigable waters. Both states take the position that New River is not navigable, either in Virginia or West Virginia, and both deny that the Federal Power Commission has any constitutional authority to impose its regulatory license on the Radford Dam or any other dam on the New River. In the brief for the State of Virginia the seriousness of the Commission's contention as it affects the State is stated as follows:

"The Federal Power Act, if construed as contended for by the appellant, amounts to a virtual prohibition of the development of Virginia's water powers by private investors, as well as by the State itself."

And it is further pointed out that the mere construction of the plant and the generation of electricity therein does not of itself constitute interstate commerce, but is within the local control of the State. Utah Power & Light Co. v. Pfost, 286 U. S. 165, 181.

Both States contend, as does also the defendant in this case, that whether the river is navigable or not, the conditions of the license not related to navigation cannot validly be imposed by the Commission because they relate to matters within the
3716 control of the State. The Supreme Court has not yet passed upon this question arising under this important federal Act, although it was apparently raised in two cases which have been dismissed for want of jurisdiction. United States v. West Virginia, 295 U. S. 463; New Jersey v. Sargent, 269 U. S.

[30] See Michie's Code of Virginia, 1936, ss. 3581 (1 to 16); West Virginia Acts of 1915, Ch. 17.

328.[31] As we think the district judge correctly found that New River was not navigable, it is unnecessary to determine that question here. There is no challenge in this case to the full power of the United States to impose such conditions with respect to dams erected in streams over which it has full property jurisdiction; nor is there any question in this case as to the right of a State to impose such conditions with respect to hydro-electric plants erected under its authority. Fox River Paper Co. v. Railroad Comm. of Wisconsin, 274 U. S. 651.

With respect to federally navigable waters the regulatory authority of Congress is plenary; but with respect to non-navigable waters, where a structure therein may prejudicially affect other navigable waters, the power of Congress is protective and preventive rather than directly regulatory; and in the latter case, as between the federal and state governments we are of the opinion that the Power Commission has no valid authority to impose conditions which in effect give the ultimate right of ownership of hydroelectric projects in state waters to the United States and thus take it from the state. If the United States wishes to acquire the property for a proper federal purpose, it must pay just compensation therefor. Of course when the electric power locally produced is transmitted in interstate commerce it comes within the proper field of control of the federal government under the interstate commerce power, with
3717 respect to which Congress has recently very fully legislated in the Federal Power Act of August 26, 1935, 49 Stat. 853, now codified as Parts 2 and 3, ss. 824, et seq. of 16 U. S. C.

It is apparent that the issues of law and fact in this case have taken a much wider range than the essential controversy between the Commission and the Company. There is obviously no real dispute between the parties as to the construction of the dam itself as affecting navigation. The plans for the structure have been approved from the standpoint of navigation; and with respect to possible effect on navigation from operations of the dam, the Company expressed its willingness to accept a license which subjected it to all proper conditions affecting navigation. Whether the Company operates a dam under a license with such conditions or without a license is of no great important with respect to the actual operation of the dam because, as a matter of law, it must be operated with due observance of the rights

[31] The Water Power Act was held constitutional as an act for improvement of navigation in Alabama Power Co. v. Gulf Power Co., 283 F. 606 (D. C. Ala.); and in Missouri v. Union El. L. & P. Co., 42 F. 2d. 692 (D. C. Mo.); see also Henry Ford & Son, Inc., v. Little Falls Fibre Co., 280 U. S. 369; United States v. Central Stockholders, etc., 43 F. 2d. 977 (D. C. Calif.).

of other riparian owners on the stream, and also in a way that will not prejudice navigable capacity of other down-stream waters; and if the Company fails at any time in its duties in this respect, the government as well as other riparian owners would be clearly entitled to appropriate injunctive relief. The only dispute between the parties was as to the power of the Commission to insist on financial and economic conditions which had no relation to navigation.

In these circumstances the court is asked to issue an injunction on the theory of protecting a navigation which the action of the government clearly shows needs no such protection. It appears the dam is now nearing completion. The alternative prayer of the bill is for a mandatory injunction to require the removal of the dam, which is obviously not really desired by anybody. The only practical effect of the issuance of the injunction at this time would be to force the defendant Company, in lieu of removal of the dam, to accept a license with conditions as to property rights which, under the facts of the case, are properly
3718 subject to the regulatory laws of the State and not of the federal government. The issuance of an injunction by a court of equity is an extraordinary remedy which should not be granted when, under all the circumstances of the case, it would seem inequitable to do so.

We conclude, therefore, that the judgment in this case must be Affirmed.

*Dissenting opinion*

PARKER, Circuit Judge, Dissenting:

This suit was instituted by the United States, under the provisions of the Rivers and Harbors Act and the Federal Power Act, to enjoin the erection and operation of a power dam in New River near Radford, Virginia, otherwise than under a license from the Federal Power Commission. The defendant is constructing at the site mentioned one of the thirty water power plants in this country of exceeding 100,000 horse power. In 1925, the New River Development Co., the predecessor of defendant, filed with the Commission "declaration of intention" to construct the dam, pursuant to sec. 23 of the Federal Water Power Act (16 U. S. C. A. 817). In 1926, defendant, having acquired the property of the New River Development Company and taken an assignment of the "declaration of intention," applied to the Commission for a license under the act authorizing the construction of the project. In 1927, the Commission, having made an investigation, found that New Rive in the part involved was not "navigable waters" within the definition of the Water Power

Act, but that "the interests of interstate or foreign commerce" would be affected by the construction, and thereupon tendered defendant a standard or major form license in accordance with the provisions of the act (16 U. S. C. A. 803). This license
3719 . defendant refused to accept. In 1930, defendant requested the Commission to reconsider its action taken in 1927 and to disclaim jurisdiction over the proposed development or, alternatively, to issue a "minor part" license pursuant to sec. 10 (i) of the act. In 1931, this request of defendant was denied, a standard form license was tendered and it was ordered that defendant not proceed with construction until it should have received and accepted such license. In 1932, the Commission re-examined the question of the navigability of New River and found it to be navigable from Wilson's Creek north, which includes the site of the proposed dam.

Defendant sued the members of the Commission to enjoin the enforcement of the provisions of the Water Power Act with respect to the project, but we held that the District Court was without jurisdiction to entertain that suit. Appalachian Electric Power Co. v. Smith, 4 Cir. 67 F. 2d 451. Defendant then began the construction of the dam and this suit was instituted by the United States to enjoin its construction or operation without the acceptance of the license which the Power Commission had tendered. The court below held that the New River was not navigable; that the erection and operation of the dam would not impair the navigable capacity of other waters; and that, even if the latter were not the case, no license is required under the act for the erection of a dam in waters which are not navigable. The bill of complaint was accordingly dismissed; and the United States has appealed.

There has been much argument as to the proper interpretation of the Federal Power Act as to construction of this character; but I think that the meaning of the act is clear. Prior to the passage of the act, the Rivers and Harbors Acts of 1890 and 1899, 26 Stat. 454 and 39 Stat. 1151 (33 U. S. C. A. 401 et seq.) forbade the construction, without the consent of Congress, of any bridge, dam, etc., in any navigable water of the United States or the creation of any obstruction to the navigable capacity of the waters of the United States. In United States v. Rio
3720 Grande Dam and Irrigation Company, 174 U. S. 690, it was held that the construction of a dam in a non-navigable portion of a river which would interfere with the navigable capacity of the navigable portion was forbidden by this legislation and that for that reason the construction of such a dam would be enjoined in a suit by the United States. One of the purposes

of the Federal Water Power Act of 1920, as amended by the Federal Power Act of 1935, was to clothe the Federal Power Commission with authority to grant licenses for the construction of dams which could not be constructed under existing law without the authority of Congress. As to dams in navigable waters, authority was granted by sec. 4 (d) of the act. There still remained, however, the obstruction to navigable capacity which might arise from construction in nonnavigable streams, and which was forbidden by sec. 10 of the Rivers and Harbors Act; and to take care of this situation the following provision was inserted in section 23 of the Act of 1920, viz:

"That any person, association, corporation, State or municipality intending to construct a dam or other project works across, along, over, or in any stream or part thereof, other than those defined herein as navigable waters, and over which Congress has jurisdiction under its authority to regulate commerce between foreign nations and among the several states, may in their discretion file declaration of such intention with the commission, whereupon the commission shall cause immediate investigation of such proposed construction to be made, and if upon investigation it shall find that the interests of interstate or foreign commerce would be affected by such proposed construction, such person, association, corporation, State, or municipality shall not proceed with such construction until it shall have applied for and shall have received a license under the provisions of this Act. If the commission shall not so find, and if no public lands or reservations are affected, permission is hereby granted to construct such dam or other project works in such stream upon compliance with State laws."

3721 The purpose of this was to give any person about to construct a dam or other project in a nonnavigable stream opportunity to have determined, in advance of construction, the question as to whether such project would affect the interests of interstate or foreign commerce. If so, a license would be granted, as in the case of a project constructed in navigable waters. If not, the project might be constructed without license. As the power of the United States to forbid such construction in any case arises from the power to prevent the obstruction of navigable waters which are highways of commerce, the finding that the interests of interstate or foreign commerce will or will not be affected necessarily means that the structure will or will not impair the navigable capacity of any navigable waters in such way as to affect such commerce. The impairment of a theoretical navigable capacity would not constitute a basis for requiring a license if the interests of commerce were not affected; but the interests of commerce would be affected within the meaning of

the act if there were an impairment of navigable capacity which would affect commerce. The amendment of this section made by the Act of 1935, instead of leaving the declaration of intention optional, requires that it be filed in all cases where the construction, while in a nonnavigable stream, will affect the interests of interstate or foreign commerce by its effect on the navigability of other waters. One proposing a construction which will have no such effect does not, of course, come within the provisions of the act.

Three questions, therefore, arise for our consideration upon the appeal: (1) whether New River at the site of the proposed construction is a navigable stream; (2) if not, whether the proposed construction will affect the navigability of waters of the United States which are navigable; and (3) whether, in either case, the requirement of the license tendered the defendant is within the power of Congress. I think that all of these questions should be answered in the affirmative.

3722 THE NAVIGABILITY OF NEW RIVER

In considering the navigability of New River, we may disregard the portions above Allisonia, Virginia, and below Hinton, W. Va.; and, as to these portions, it may be assumed that the stream is non-navigable. I think, however, that the 110 mile stretch extending across the Appalachian Plateau from Allisonia to Hinton is clearly shown to be navigable. The 26 mile stretch above Hinton to Wylie's Falls, Va. and the 25 mile stretch above Radford are unquestionably navigable and were so found by the court below. They were improved for purposes of navigation by the federal government in the 1880s; and the evidence shows that they were used for purposes of navigation before as well as after these improvements were made. The intervening stretch between Wylie's Falls and Radford was not used to the same extent; but the evidence shows that substantial use was made of it and the conclusion is justified that it was not used to a greater extent because it was paralleled by a railway which furnished a more desirable means of transportation. The stretches above Hinton and above Radford were used as means of transportation to the railways at those points; but after the Cripple Creek branch of the N. & W. Railway was built in the '80s paralleling the river above Radford, it took the traffic from the river, and even this stretch, which had been improved by the government, was used but little.

The river throughout this 110 mile stretch has an abundance of water. The average stream flow at the site of defendant's project a few miles above Radford is 3,211 cubic feet per second and the

drainage area of the river at this point is 2,400 square miles. River vessels can navigate in water having a rate of flow of 5 or 6 miles per hour, whereas the rate of flow of this river is one mile per hour in the pool water and not exceeding a
3723 maximum of 4.4 miles per hour in the channels of the falls or rapids. It is true of the unimproved portion of the river between Radford and Wylie's Shoals, as it is of the improved portions, that 85 per cent of the distance consists of pools of a navigable depth of several feet, whereas the rapids or shoals which account for the remainder of the distance are traversed by natural channels, having a minimum depth of approximately two feet even in low water. These channels have been deepened and widened in the stretches above Hinton and Radford to which we have referred. The average slope of the river is approximately four feet per mile throughout this entire distance and is no greater in the unimproved portion than in the portions that have been improved. There are a number of shoals; but the percentage of shoal water is no greater and the obstruction no more formidable between Radford and Wylie's Shoals than in the portions of the river which were improved and which were held navigable by the court below. So far as the natural condition of the river is concerned, therefore, I can see no difference in navigability between the portion between Radford and Wylie's Shoals and the stretches above Hinton and Radford.

There can be no question as to the substantial character of the commerce which was carried down the river over the stretches above Radford and Hinton. The boats used in this commerce were bateaux or keel boats having an average length of 60 feet, a width of 6 to 8 feet and a draft of two feet, and capable of carrying a load of 20,000 to 27,000 pounds. There were 17 of these keel boats operating at one time above Hinton and eight above Radford. Lumber and staves in large quantities were carried down the river for shipment by rail at Hinton and pig
3724 iron for shipment at Radford. Operation of steamboats was attempted, but was not successful. As to the intervening stretch, there is abundant evidence of operation of keel boats on it before the building of the railroad from Glen Lyn to Radford. The witness Anderson testified (469)[32] to moving his father's household goods down the river from Eggleston Springs to True in 1879. The witness Collins testified (321–6) to trips with his father down the river from Radford to Hinton and of stops on the trips at the Narrows and at Crump's Bottom, also that he had seen cross ties and staves brought by boat from the Narrows to Hinton, and that he had rafted timber and logs down

[32] References are to Vol. 2 of appellant's appendix.

the river. The witness Dickenson (420–25) testified as to supplies being carried up the river by boat from Hinton to Shumate's Falls and thence by wagon to Glen Lyn. The witness Flannagan testified that the keel boats plied up and down the river from Hinton to Allisonia (303–6). The witness Helvey testified to grain being carried by boat up the river from the horseshoe to Radford and of the use of boats in the river (458–460). The witness Hoover testified to shipping supplies by boat from Hinton to the camp of the railroad contractors at East River or Glen Lyn (447). The witness Linkous, when a boy and living at Pepper Tunnel below Radford, had seen boats going up and down the river operated by former slaves whose names he remembered. He remembered also selling eggs to the boatmen and their custom of blowing a bugle as they passed (311). The witness Martin who lived at Eggleston testified to working in a boat on the river and carrying it up the river to Radford and selling it (465). The witness Price who lived near Tom's Creek when a boy saw boats going up and down the river loaded with coal, corn, wheat, crated chickens, hogs and produce of all sorts (401–405). The witness Skeen, a Confederate veteran, testified that while camped at the Narrows he saw boats going up and down the river, bringing provisions to the commissary at the Narrows (399). The witness Snidow who lived at Pembroke six miles below Eggleston testified to seeing the boats operating on the river during the Civil War, and of the management of the boats by a Captain Burke, and of how the boats, 4 or 6 in number, were loaded with grain and sent down the river (364–6). The witness Snodgrass who lived at Eggleston saw boats operated in the river and saw them bring supplies down the river to the railroad contractors (370–3). The witness Snyder saw boats operated between Radford, Eggleston and the Narrows during the Civil War loaded with supplies for the soldiers. He testified also that after the War his father operated a boat, going as far down the river as Hinton (346–50). The witness Webb who lived at the Horse Shoe on New River saw boats going up and down the river and heard the boatmen say that they went as far as Hinton (327). He testified that for several years after the Civil War the barges were operated by hired hands and hauled wheat and lumber (328). The witness Coleman operated a steamboat for six or seven months from Pepper's Ferry to Pepper's Tunnel (306). The witness Jones testified to bringing logs by raft or loose down the river from Narrows to Hinton (378). The witness Medley testified to working in bataux in the river from Hinton to Mercer's salt works and from there to Radford, of bringing fertilizer from Glen Lyn to the salt works, of bringing staves from Wylie's Island, and of moving a man's household

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goods up the river to Radford (412–13). The witness Owen testified to carrying the government boats which had been engaged in the river work above Radford down the river to Hinton where they were sold (337). The witness Peters testified to hauling tobacco by boat from Glen Lyn to Hinton for shipment by rail (390). He also testified that he worked on the river in boats for 16 or 18 years, that in the Spring he would go up the river to Glen Lyn to get fertilizer, and that while the N. & W. R. R. was in process of construction he went up nearly every week (385). The witness E. M. Smith testified to working on river boats for 9 years and carrying groceries and other merchandise to Glen Lyn and carrying lumber, staves, tobacco
3726 and tanbark down stream (428). The witness Weiss testified to the operation of one of the keel bottom boats by his brother and of his hauling staves and other things from Glen Lyn to Hinton (331).

The foregoing testimony is not contradicted nor discredited, and I do not understand that the District Judge rejected it. On the contrary he accepted it but failed to appraise it properly, saying: "It is not meant to say that continuous movement of such boats between Hinton and the vicinity of Radford was impossible or did not occur. There is evidence which indicates that it did occur, but there is a vagueness about the extent to which it occurred and indications that such trips were irregular, were attended with difficulty and formed no appreciable part of any commercial transportation which took place on the river." To my mind this testimony establishes beyond question not only the navigable capacity of the river for the purposes of useful commerce, but also that it was in fact navigated and used as a highway of commerce. That a considerable portion of the commerce was interstate in character does not admit of doubt; but, even if this were not true, the use made of the stream shows conclusively that it was capable of serving as a highway for such commerce between Allisonia and Hinton for river boats of light draft, such as were undoubtedly in regular use on the river prior to the coming of the railroads.

The fact that Congress has dealt with this portion of New River as a navigable water of the United States, while not conclusive, is a circumstance of great weight to be considered by the court. U. S. v. Brewer Elliott Mule Co., 249 F. 609, 618. And contemporaneous reports made to Congress show unquestionably the navigable character of the stream. Thus the report of Colonel, then Major, Craighill attached to the report of the Secretary of War in 1873 quotes the following from a report made in 1819 by Moore and Briggs who made a survey

3727 of the river for 54 miles above Hinton under the auspices of the Board of Public Works of the State of Virginia:

"This is truly a noble river. Notwithstanding it was represented to us as being remarkably low, yet it afforded (July 1819) a superabundance of water for every purpose of internal navigation. The fall in this part of the river, considering the mountainous country it passes through, is comparatively moderate. The principal falls are the Bull Falls, McCaniel's, Anderson's, Wiley's, Neilley's, and Peter's Mountain Falls—none of which have been improved in the least degree, yet we ascended them all with our boat, though in two or three instances with considerable difficulty, after taking out our baggage, stores, &c."

Col. Craighill's report shows that keel boat traffic existed on the river at that time and recommended improvement of the channel for navigation particularly with reference to connection with the intersecting interstate railroads. He states:

"But little has been done in the way of improving the river since the time of Moore and Briggs, though an effort is said to have been made in that direction by the confederate government during the late war. Mr. Hutton states that the keel boats now used draw about 12 inches when two-thirds loaded. By the construction of slight deflectors or dams of rock and brush, both of which materials abound, the volume of the water may be concentrated and the depth over the shoals increased from the present average of about 12 inches to about 2 feet, without too much increase of velocity of current. Some of the falls, which are almost always vertical and of an average height of about 4 feet, could be greatly improved by blasting sluices through them, about 30 feet in width, and of an average length of 50 feet. It is to be observed that the falls have in many cases natural chutes or sluices through them, susceptible, also, of such improvement as that just indicated.

"What has been said above refers to a keel boat navigation, but the pressure for the improvement of this river
3728 is increased by the development of the railroads which intersect it and afford the means of rapid transport east and west for the commodities to be procured along and near the stream. There is a demand for the steam navigation."

The Hutton report attached to the report of Col. Craighill contains a mile by mile description of the character of the stream from the Lead Mines to Hinton, a distance of 128 miles, and refers in the following terms to the commerce on the river and the extent of the improvement contemplated:

"The present system of transportation on this portion of the river is by keel boats which carry from two to three tons, and

are rowed or floated down the river and poled up. An expenditure of $100,000 would greatly ameliorate the condition of the river for this trade, and enable the trips to be made with so much more certainty as to induce a considerable increase of trade."

The report of the Chief of Engineers for the year 1877 showed the existence of keel boat traffic, and that its improvement above Radford (New River Bridge) was for the purpose of facilitating traffic connecting with the interstate railroad which crossed the river at that point. The report states:

"The first appropriation for the work was $15,000, August 14, 1876; but it was not made available until May 1877. As this appropriation was insufficient for a general improvement, it seemed necessary to confine what should be done at present to a limited portion of the river, and to that scheme which involved the least expense, viz, *for the keel boats now in use*, it being the understanding that what is first done in the smaller improvement should be arranged with a view to its utilization and adaptation some future day, when the means provided shall suffice to enter upon the improvement of the river for light steamboats.

"It seemed also expedient that the first portions of
3729 the river treated should be in the vicinity of New River Bridge, in order to facilitate communication of at least a portion of the country through which the river flows with an existing outlet east and west—the Virginia and Tennessee Railroad—which is itself in connection with the whole system of rail and water intercommunication of the country." [Italics supplied.]

The report of the Chief of Engineers for the year 1880 contains the following statement:

"In August, 1878, it was decided to commence work at once on the section of the river immediately above the mouth of Greenbrier, at Hinton, in West Virginia, as the indications of immediate usefulness of the improved river in that section seemed greater than in the section worked over by Captain Cuyler. The operations near Hinton were placed under the supervision of Mr. A. M. Scott, and vigorously continued until near the end of November, 1878. The work was resumed in June, 1879, under Col. William Proctor Smith. The reports of Mr. Scott and Colonel Smith in the annual report for 1879, and hereto appended, give the detailed history of the progress made up to June 30, 1880. A steamboat has been built at Hinton and runs on the river, taking advantage of the improvement as high as it has been carried above that point, about 15 miles. The bateaux have much greater ease in navigation and can carry larger loads."

The work done by the government was in three divisions: the Lower or Greenbrier division, extending 86½ miles from Hinton to Radford, the Middle or New River Bridge division extending 43 miles above Radford, and the Upper or Lead Mines division, extending for 62 miles. The last named division was far above the section of the river with which we are dealing and was the section referred to in the Craighill report recommending abandonment of the work and quoted by the court below. The reports show that on the lower and middle divisions there was substantial traffic, which was increased as a result of the work done. The following statement is contained in a report of 1881:

3730 "On the lower division there are thirteen keel boats and a small side-wheel steamboat, 75 feet long, 10 feet wide, and 3 feet deep, with another 100 feet long and 15 feet wide being built. Four of the keel boats run up to Shumate's Falls, 28 miles, carrying supplies to the New and East River Railroads.

"On the middle division there are eight keel boats and parties are about to build a small tugboat and a light-draught steamboat to carry ores down to New River Bridge.

"The tables following show that of the freight shipped from the stations on the Chesapeake and Ohio Railway, which are outlets to the river on the lower division, 70 per cent is from New River, an increase over 1880 of 36½ percent.

"The shipments from the various stations on the Norfolk and Western Railroad show an increase of 33 per cent. The shipments by river to New River Bridge Station began too late in December for any freight to be sent by rail."

The following is in a report of 1883:

"It has hardly been practicable to accomplish at any one of the very many points needing improvement all that has been desirable, but the worst places have been worked upon to the greatest extent, and efforts thus been made to increase the available navigability of the river over as long stretches as possible, and to increase the facilities for access of the greatest number to the railroads touching the river, and thus connecting with the eastern and western markets districts otherwise much isolated and hitherto dependent on teaming to railroad stations over long and bad roads.

"Should work be resumed, it will be found difficult to collect and organize as efficient a force as that which has been disbanded and necessarily scattered. To replace such a machine takes time and money.

"The number of large boats on the river for carrying freight has increased to twenty-five. The following im-

3731 portant facts are taken from the report of the superintending engineer:

"Of the freight sent from Hinton in 1882, 95 per cent came from New River, an increase over 1881 of 46 per cent.

"Of the freight received at Hinton in 1882, 43 percent went up the river; 24½ percent increase on shipments from Hinton in 1882 over 1881; 9 per cent increase on freight received at Hinton in 1882 over 1881.

* * * * *

"The navigation of the river not being continuous as yet, it is practically a feeder to the railroads which cross it and run along portions of it. It has also been of much use in carrying materials and supplies to the railroads while in process of construction near it. It is probable that when the river is fully improved boats will transport one-third of the products of the fine agricultural country through which it flows, and seven-eighths of those of the mines, exclusive of coal."

To the report of the Secretary of War made in 1913 is appended a report of the District Engineer who investigated the feasibility of further improvement of the river, containing the following statement:

"Above Glen Lynn the river is paralleled most of the way by two railroads, and there is no river commerce. From Hinton to Glen Lyn, a distance of 30 miles, there is some commerce, consisting of lumber, staves, sand, gravel, and also some grain, hay, farm products, and miscellaneous merchandise. No statistics are on hand, but I am informed that the commerce at Hinton amounts to about two railroad carloads per day, and, as Hinton is the only town on this 30-mile section, this is some measure of its amount. This estimate of two carloads a day is thought to be excessive and is believed to be true only at times. In 1883 there were about 17 keel boats in this traffic, and there are said to be 10 or 12 such boats now on the river. These keel boats, as they are called, are the popular boats for this traffic, having an average length of 60 feet, width of 6 to 8 feet, and carrying 20,000 to 27,000 pounds. Their draft is generally about
3732 2 feet. The commerce is altogether local. During the winter season, from December 1 to April 1, the roads are in poor condition, and the inhabitants experience difficulty in transportation of supplies. The section from Glen Lyn to Hinton lies almost entirely in Summers County and only traverses about one-half of it. Summers County had a population, at the last census, of 18,420. Probably no more than 2,000 or 3,000 people at most are in any way dependent upon this section of the river.

The improvement of the river would probably cause a small increase in commerce, but not a very large one, as there is nothing to move."

In the light of this evidence I do not think that a finding of navigability can be avoided. The question is not whether modern steamboats are using or can use the river, but whether it is susceptible of use by any sort of craft used for commercial purposes. As said by the Supreme Court in The Montello, 20 Wall. 430, 441:

"It would be a narrow rule to hold that in this country, unless a river was capable of being navigated by steam or sail vessels, it could not be treated as a public highway. The capability of use by the public for purposes of transportation and commerce affords the true criterion of the navigability of a river, rather than the extent and manner of that use. If it be capable in its natural state of being used for purposes of commerce, no matter in what mode the commerce may be conducted, it is navigable in fact, and becomes in law a public river or highway. Vessels of any kind that can float upon the water, whether propelled by animal power, by the wind, or by the agency of steam, are, or may become, the mode by which a vast commerce can be conducted, and it would be a mischievous rule that would exclude either in determining the navigability of a river. It is not, however, as Chief Justice Shaw said (21 Pickering, 344) "every small creek in which a fishing skiff or gunning canoe can be made to float at high water which is deemed navigable, but, in order to give it the character of a navigable stream, it must be generally and commonly useful to some purpose of trade or agriculture."

The fact that shoals and rapids in the river made navi- 3733
gation difficult and prevented the adoption of modern agencies of navigation is not conclusive of non-navigability. The same situation confronted the court in The Montello, supra, where the court said:

"The learned judge of the court below rested his decision against the navigability of the Fox River below the De Pere Rapids chiefly on the ground that there were, before the river was improved, obstructions to an unbroken navigation. This is true, and these obstructions rendered the navigation difficult, and prevented the adoption of the modern agencies by which commerce is conducted. But with these difficulties in the way commerce was successfully carried on, for it is in proof that the products of other States and countries were taken up the river in its natural state from Green Bay to Fort Winnebago, and return cargoes of lead and furs obtained. And the customary

mode by which this was done was Durham boats. As early as May, 1838, a regular line of these boats was advertised to run from Green Bay to the Wisconsin portage. (Doty v. Strong, 1 Pinney, 316). But there were difficulties in the way of rapid navigation even with Durham boats, and these difficulties are recognized in the Ordinance of 1787, for not only were the 'navigable waters' declared free, but also the 'carrying-places' between them, that is, places where boats must be partially or wholly unloaded and their cargoes carried on land to a greater or less distance. Apart from this, however, the rule laid down by the district judge as a test of navigability cannot be adopted, for it would exclude many of the great rivers of the country which were so interrupted by rapids as to require artificial means to enable them to be navigated without break. Indeed, there are but few of our fresh-water rivers which did not originally present serious obstructions to an uninterrupted navigation. In some cases, like the Fox River, they may be so great while they last as to prevent the use of the best instrumentalities for carrying on commerce, but the vital and essential point is whether the natural navigation of the river is such that it affords a channel for useful commerce. If this be so the river is navigable in fact, although its navigation may be encompassed with difficulties by reason of natural barriers, such as rapids and sand-bars."

3734 And the fact that the river has been used for purposes of commerce establishes its navigability, even though its use may have been discontinued as a result of more improved methods of transportation. What was said by the Supreme Court in Economy Light and Power Co. v. United States, 256 U. S. 113, 123, is conclusive of this point. The Court said:

"We concur in the opinion of the Circuit Court of Appeals that a river having actual navigable capacity in its natural state and capable of carrying commerce among the States, is within the power of Congress to preserve for purposes of future transportation, even though it be not at present used for such commerce, and be incapable of such use according to present methods, either by reason of changed conditions or because of artificial obstructions. And we agree that the provisions of sec. 9 of the Act of 1899 (30 Stat. 1151) apply to such a stream. The act in terms applies to 'any * * * navigable river, or other navigable water of the United States'; and, without doing violence to its manifest purpose, we cannot limit its prohibition to such navigable waters as were, at the time of its passage, or now are, actually open for use. The Desplaines River, after being of practical service as a highway of commerce for a century and a half, fell into disuse, partly through changes in the course

of trade or methods of navigation, or changes in its own condition, partly as the result of artificial obstructions. In consequence, it has been out of use for a hundred years; but a hundred years is a brief space in the life of a nation; improvements in the methods of water transportation or increased cost in other methods of transportation may restore the usefulness of this stream; since it is a natural interstate waterway, it is within the power of Congress to improve it at the public expense; and it is not difficult to believe that many other streams are in like condition and require only the exertion of federal control to make them again important avenues of commerce among the States. If they are to be abandoned, it is for Congress, not the courts, so to declare. The policy of Congress is clearly evidenced in the Act of 1899, and, in the present case at least, nothing remains but to give effect to it."

3735 Certainly the New River between Allisonia, Va. and Hinton, W. Va. is as clearly navigable as was the Fox River held navigable in The Montello, supra, or the Desplaines River held navigable in Economy Light and Power Co. v. United States, supra, or the sections of the Green, Grand and Colorado Rivers, held navigable in United States v. Utah, 238 U. S. 64, or the Tennessee River at the site of the Wilson dam, held navigable in Ashwander v. Tennessee Valley Authority, 297 U. S. 288, 328. In the case last cited the court adverted to obstructions at various points because of "shoals, reefs and rapids" and to the fact that in its present condition the river was not adequately improved for commercial navigation and the traffic on it was small, but held it navigable nevertheless. Little light is thrown on the case by the decisions in Leovy v. United States, 177 U. S. 621 or United States v. Doughton, 4 Cir. 62 F. 2d 936. In the first of these cases, the Supreme Court dealt with Red Pass, a crevasse caused by the overflow of water from the Mississippi, upon which no commerce of any sort had ever been conducted. In the second, this court dealt with Wilkerson's Creek as to which the same situation existed.

But there is another and equally valid reason why the New River must be held a navigable water of the United States at the site of the proposed dam. Whatever may be found as to other portions of the river, there can be no question that the dam is located on a portion which is navigable, which has been improved for navigation by the federal government, and which has been used as a highway for interstate commerce through connection with the interstate railway which crosses the river at Radford. Whether this navigable stretch of the river extends into another state or not, therefore, it furnishes in connection with the railroad a highway of interstate commerce, has been used for that purpose and is a

water of the United States subject to the control of Congress for that reason. In the Daniel Ball, 10 Wall. 557, the navigation
3736 laws were applied to a steamboat operating on the Grand River entirely within the State of Michigan. It was contended that the vessel was not subject to the navigation laws even though operated upon a navigable river of the United States, because she did not carry merchandise beyond the boundaries of the state and was not operated in connection with any line of vessels or railway. It was held, however, that the vessel was subject to the control of Congress, because the articles that she carried were moving in an interstate journey. The court said:

"In this case it is admitted that the steamer was engaged in shipping and transporting down Grand River, goods destined and marked for other States than Michigan, and in receiving and transporting up the river goods brought within the State from without its limits; but inasmuch as her agency in the transportation was entirely within the limits of the State, and she did not run in connection with, or in continuation of, any line of vessels or railway leading to other States, it is contended that she was engaged entirely in domestic commerce. But this conclusion does not follow. So far as she was employed in transporting goods destined for other States, or goods brought from without the limits of Michigan and destined to places within that State, she was engaged in commerce between the States, and however limited that commerce may have been, she was, so far as it went, subject to the legislation of Congress. She was employed as an instrument of that commerce; for whenever a commodity has begun to move as an article of trade from one State to another, commerce in that commodity between the States has commenced. The fact that several different and independent agencies are employed in transporting the commodity, some acting entirely in one State, and some acting through two or more States, does in no respect affect the character of the transaction. To the extent in which each agency acts in that transportation, it is subject to the regulation of Congress."

It is the movement of commerce interstate which makes the commerce clause of the Constitution applicable. Any instru-
3737 mentality of such commerce is subject to the control of Congress; and a body of water, even though entirely within the limits of a state, falls within the principle if interstate commerce moves over it. Here the stretch of the river for 25 miles above Radford furnishes a highway for such commerce. Congress recognized the fact and expended money in its improvement. And Congress has done nothing to surrender the control which it thus saw fit to exercise.

I am familiar with the statement of the rule as to navigability which contains the expression that "they constitute navigable

waters of the United States * * * when they form in their ordinary condition by themselves, or by uniting with other waters, a continued highway over which commerce is or may be carried on with other states or foreign countries in the customary modes in which such commerce is conducted by water." I do not think, however, that this statement was intended to limit the power of Congress over a stream which is in fact a highway of interstate commerce moving partly by rail. There can be no question as to the power of Congress over an intrastate railroad over which interstate commerce moves. Colorado v. United States, 271 U. S. 153. And there can be no difference in principle with respect to a stretch of water wholly within a state which serves as a highway for interstate commerce. A different question would be presented if an intrastate stretch of water capable of use in interstate commerce had never been used for that purpose. Here, however, the waterway has been used in connection with a railway as a highway of interstate commerce and to that end has been improved by Congress through expenditure of moneys of the United States.

THE EFFECT ON NAVIGATION

The power project of defendant is one of the larger projects of the country. The dam is 110 feet high with a draw down of 27 feet, and the machinery has capacity for utilizing a
3738 flow of 9,000 cubic feet of water per second, or approximately three times the average flow of the stream. Peak load or near peak load operation is contemplated, i. e. the water will be permitted to flow through the turbines for only a part of each twenty-four hours to take care of the higher demand for electricity which exists for only part of the day. This necessarily means that the flow of the stream will be almost entirely shut off for a portion of the day and the volume of water released will be greatly in excess of normal stream flow while the turbines are operating. This will cause waves in the stream below the dam which will persist far down the river and will even cause the rise and fall of the Kanawha at the head of navigation on that river. In dry weather when the flow is low, it will be possible to shut off the stream flow for long periods and affect the navigability to a marked degree.

The question as to whether the operation of the dam will affect the navigable capacity of an interstate stream, disregarding the navigable capacity at the dam site, is easily disposed of if regard be had to the interstate stretch of the river between Glen Lyn, Va., or Wylie's Falls, Va., and Hinton, W. Va. That this stretch of the river is navigable does not seem to me to admit of doubt.

Millions of feet of lumber and staves were transported over it, and it was improved by the federal government. The improvement extended from Hinton, W. Va. to beyond the Virginia line at Wylie's Falls. That there was commerce on the river as far up as Glen Lyn is proven beyond all reasonable doubt and is referred to in the government reports. Whatever may be the effect of the operation of the dam on the Kanawha, there can be no question that it will affect the navigability of New River from Glen Lyn to Hinton. Counsel for defendant admit this but contend that the stretch of the river is not navigable. As stated, however, I think that the showing as to its navigability is beyond question.

And I think that we must consider the effect which the
3739 operation of the dam might have upon the navigability of the Kanawha. It is said that this need not be considered because of the rectifying effects of the dams farther down stream and of the Bluestone flood control project, the construction of which is virtually assured. The power of Congress to control the construction of a dam which may affect the navigation of a stream is not affected by the existence of dams lower down stream, for these might be removed. The servitude in the interest of navigation must be determined by consideration of the stream in its natural condition. United States v. Cress, 243 U. S. 316. A corollary of this is that the power of Congress to control stream flow of navigable streams is not impaired as the result of construction which may render the exercise of the power unnecessary. It is argued, also, that it would not be wise from the standpoint of its own interests for defendant to operate its dam in such way as to interfere with the navigable capacity of the streams below; but the fact that the structure is of such character that it is capable of being operated so as to affect navigation brings it within the regulatory power of Congress. It is clear that, in such case, the government need not depend upon the wisdom or public spirit of private persons to protect the interests of navigation but may itself take action which will guarantee their protection.

But more important than any of the other effects which the construction and operation of the dam will have on the navigability of navigable waters is the effect that it will have upon navigation in the Ohio River as a result of effecting means of controlling flood waters in the Kanawha. One of the most important enterprises of the federal government is flood control in the Ohio. While this is important from the standpoint of protecting navigation in the Ohio, and while federal power in the premises is based upon this consideration, its importance to

the people of the United States far transcends the mere matter of navigation in view of the tremendous loss of life and
3740 property which these floods entail. To adequately control the floods, the federal government must provide for flood control in the various tributaries of the Ohio; and control is nowhere more important than in the New and Kanawha Rivers, which pour into the Ohio waters from a large portion of the mountainous section of Virginia and West Virginia. It appears from the record that the New River furnishes at ordinary times nearly one-fourth of the stream flow of the Ohio below the mouth of the Kanawha; and in rainy season flood waters from the mountains pour down New River through the Kanawha and into the Ohio in tremendous volume. To aid in the control of these flood waters, dams in the New River are imperative; and the Bluestone project near Hinton is being undertaken primarily as a means of flood control. Other dams above Bluestone, if properly constructed and operated, will aid in flood control and will affect navigation in the Ohio in that way.

It is argued that the dam of defendant can be of aid in flood control, and this is no doubt true; but the argument concedes that the construction and operation of the dam will affect navigation since it will affect flood control. Whether the effect will be favorable or not depends upon how the dam is operated. In the operation of flood control dams, the object is to keep the pond as low as possible at all times so as to provide readily available storage for flood waters when they come. In the operation of power dams, the object is to keep the pond as nearly full as possible at all times so as to have maximum power available. It is clear, therefore, that the construction and operation of power dams can vitally affect flood control in the river; and that, when the construction of such dams is permitted in a river where flood control is as important as it is in New River, they should be subject to the control of the federal government so that they can be operated in connection with the purely flood control dams, as a unitary system.

3741 THE POWER OF CONGRESS TO REQUIRE THE LICENSE

In the Power Act, Congress substituted administrative for direct legislative and judicial control, i. e. instead of forbidding absolutely the construction of dams in navigable waters or dams which would affect the navigable capacity of navigable waters, it set up an administrative tribunal and authorized it to license the construction of such dams when found to be in the public interest. There can be no question as to the power of Congress

to prohibit absolutely the construction of operation of dams which will interfere with navigation in a navigable stream whether the dam itself be located in a stream which is navigable or non-navigable. United States v. Rio Grande Dam & Irrigation Co., 174 U. S. 690. The existence of private rights is no more an impediment to the exercise of federal power in the one case than in the other; for, in either case, private rights are held subject to the paramount power of Congress to protect the public interest in interstate commerce, by forbidding any construction that would interfere therewith. Nor does this involve infringement of the rights of the states protected by the Tenth Amendment to the Constitution. As said by the Supreme Court in the Rio Grande case, where rights were asserted under a law of New Mexico to divert waters of the Rio Grande in the non-navigable section of the river:

"Although this power of changing the common law rule as to streams within its dominion undoubtedly belongs to each State, yet two limitations must be recognized: * * *. Second, that it is limited by the superior power of the general government to secure the uninterrupted navigability of all navigable streams within the limits of the United States. In other words, the jurisdiction of the general government over interstate commerce and its natural highways vests in that government the right to take all needed measures to preserve the navigability of
3742 the navigable water courses of the country even against any state action.

* * * * *

"It is urged that the true construction of this act limits its applicability to obstructions in the navigable portion of a navigable stream, and that as it appears that although the Rio Grande may be navigable for a certain distance above its mouth, it is not navigable in the Territory of New Mexico, this statute has no applicability. The language is general, and must be given full scope. It is not a prohibition of any obstruction to the navigation, but any obstruction to the navigable capacity, and anything, wherever done or however done, within the limits of the jurisdiction of the United States which tends to destroy the navigable capacity of one of the navigable waters of the United States, is within the terms of the prohibition. Evidently Congress, perceiving that the time had come when the growing interests of commerce required that the navigable waters of the United States should be subjected to the direct control of the National Government, and that nothing should be done by

any State tending to destroy that navigability without the explicit assent of the National government, enacted the statute in question. And it would be to improperly ignore the scope of this language to limit it to the acts done within the very limits of navigation of a navigable stream."

But the power of Congress is not limited to prohibition of obstructions to interstate commerce. Possessing full power of control in the premises, it may intrust to an administrative agency the regulation and licensing of structures which it has the power to prohibit. And I see no objection to exacting as a condition of the licenses granted a requirement as to the rates to be charged for electric power to be manufactured by the licensees or an option on the part of the government to purchase either at cost or market value. The water power of the streams of the country is one of the most valuable of the natural resources of the people. It does not belong as a matter of private right to the owners of power sites, but can be enjoyed by them only
3743 if the government consents to the obstruction or interference with the streams involved in the erection of dams. It is but fitting that the government, which holds its power for the benefit of the whole people, prescribe as a condition of its consent to the erection of such dams that the people shall derive a benefit from the concessions granted, to the extent of being accorded reasonable rates upon the product of the enterprise. And, since no one can forsee the future, or prophesy to what extent such obstructions may become undesirable from the standpoint of the public interest, it is proper that the license for their maintenance be limited and that provision be made for their purchase by the public. The exaction of the right on the part of the government to acquire the project upon the terms contained in the license is in no sense a denial of due process, but is the price exacted by the government for the granting of a permission which it has the right to withhold. Fox River Paper Co. v. Railroad Commission of Wisconsin, 274 U. S. 651. Nor is it any objection that ownership by the government of the power project may result from such acquisition. If the government may build a power project itself in connection with regulating the navigability of streams, as held in Ashwander v. United States, 297 U. S. 288, there can be no objection to its licensing another to build the project with a view of subsequent acquisition by the government.

If the stream at the dam site be held navigable, there can be no question as to the power of Congress to construct a dam and power

project there in aid of navigation. Ashwander v. Tennessee Valley Authority, supra. And it is equally clear that, even if it be nonnavigable, it may construct such dam and power project for purposes of flood control in streams below. United States v. West Virginia Power Co., 4 Cir. 91 F. 2d 611. What the government may thus do itself, it may license a private corporation to do upon such terms and conditions as, in the opinion of Congress, the public interest may require.

3744 Much has been said about the effect of the findings of the Federal Power Commission, but I do not think it necessary to go into this. Assuming that the questions thus raised are jurisdictional and go to the constitutional validity of the action of the Commission, so that they are subject to full review under the doctrine of Crowell v. Benson, 285 U. S. 22, I think that the record before the court below fully justifies the Commission's action and that the injunction prayed by the government should be awarded. As a practical matter, this does not mean, of course, that the defendant will be enjoined from constructing or operating the dam, but merely that, as a condition of such construction and operation, it be required to accept the license tendered by the Commission.

There are certain facts in this case which cannot be overlooked. Defendant is constructing one of the thirty largest power dams in the United States, and is constructing it at a place where the river unquestionably has been used as a highway of interstate commerce and has been improved for that purpose by the expenditure of federal funds. The river at the site of the dam has been found a navigable water of the United States by a commission appointed by Congress to deal with such matters and acting under oath in the discharge of a public duty. Even if the river be held nonnavigable at the site of the dam, there can be no question but that the operation of the dam will affect the navigability of the stream between Glen Lyn, Va. and Hinton, W. Va., which is navigable within any test which the Supreme Court has prescribed. And, in addition to all this, the construction of dams in New River will vitally affect flood control in the Ohio and thereby affect navigation in that great highway of commerce. Under such circumstances, I cannot agree that the federal government is without power to require a license of defendant as a condition of the construction of the dam, or that the government must await actual interference with existing commerce before taking action.

3745 In United States Circuit Court of Appeals,
Fourth Circuit

No. 4460

UNITED STATES OF AMERICA APPELLANT

*vs.*

APPALACHIAN ELECTRIC POWER COMPANY, A CORPORATION, APPELLEE

Appeal From the District Court of the United States for the Western District of Virginia

*Decree*

Filed and Entered November 6, 1939

This cause came on to be heard on the transcript of the record from the District Court of the United States for the Western District of Virginia, and was argued by counsel.

On consideration whereof, it is now here ordered, adjudged, and decreed by this Court that the decree of the said District Court, in this cause, be, and the same is hereby, affirmed.

November 6th, 1939.

JOHN J. PARKER,
*Senior Circuit Judge.*

December 11, 1939, petition of appellant for a stay of the mandate is filed.

In United States Circuit Court of Appeals

*Order staying mandate*

Filed December 13, 1939

Upon motion filed by the Appellant, and good cause having been shown, it is ordered that the mandate of this Court upon the decree entered on November 6, 1939, in the above entitled matter be and it is hereby stayed until the final disposition
3746 of this cause by the Supreme Court of the United States, or until February 6, 1940, if no petition for a writ of certiorari is filed by that time.

JOHN J. PARKER,
John J. Parker,
*Senior Circuit Judge.*

DEC. 12, 1939.

3747 In United States Circuit Court of Appeals

*Order as to use of original transcript of record*

Filed December 30, 1939

It appearing to the Court that the appellant in the above-entitled case has applied to the Clerk of this Court for a certified transcript of the record for use in the Supreme Court of the United States on an application for a writ of certiorari to this Court, and it further appearing that counsel for the appellant desire that the Clerk, in making up said transcript of the record, use the original transcript of the record filed in this Court in this cause, it is now therefore ordered by this Court, that the Clerk of this Court, in making up the certified transcript of record for use in the Supreme Court of the United States on the application of the appellant for a writ of certiorari to this Court in this cause, be, and he is hereby authorized to use and incorporate therein the original transcript of record filed in this Court, and add thereto copies of the proceedings in this Court in said cause. The said original transcript of record shall be returned to this Court after the case is finally disposed of in the Supreme Court.

JOHN J. PARKER,
*Senior Circuit Judge.*

DECEMBER 29, 1939.

3748 [Clerk's certificate to foregoing transcript omitted in printing.]

3749 Supreme Court of the United States

*Order allowing certiorari*

Filed March 4, 1940

The petition herein for a writ of certiorari to the United States Circuit Court of Appeals for the Fourth Circuit is granted.

And it is further ordered that the duly certified copy of the transcript of the proceedings below which accompanied the petition shall be treated as though filed in response to such writ.

The Chief Justice took no part in the consideration and decision of this application.

3750 In Supreme Court of the United States

*Stipulation as to printing of record*

Filed March 8, 1940

It is hereby stipulated and agreed by and between the counsel for the respective parties in the above entitled action that the following numbered pages [33] of the typewritten transcript of the record as originally certified by the Clerk of the United States District Court for the Western District of Virginia to the United States Circuit Court of Appeals for the Fourth Circuit, and thereafter certified to this Court by the Clerk of said United States Circuit Court of Appeals for the Fourth Circuit, may be omitted from the record to be printed for this Court:

Pages 519–521 (testimony of P. H. McGrath).
Page 522 (testimony of D. H. Kauffelt).
Pages 523–4 (testimony of J. J. Green).
Pages 1441–52 (testimony of E. A. Sherman).
Pages 1453–76 (testimony of C. L. Forsling).
Pages 1477–1509 (testimony of Dr. H. T. Cory).
3751 Pages 1821–34 (testimony of Dr. F. F. Barnes).
Pages 3127–3163 (Exhibits A, B, and C of Exhibit 90).
Page 3498 (Exhibit 239).
Pages 3499–3564 (Exhibit 240).
Dated March 5, 1940.

FRANCIS BIDDLE,
*Solicitor General,*
*Counsel for Petitioner.*
FRASER M. HORN,
WENDELL W. FORBES,
*Counsel for Respondent.*

[File endorsement omitted.]

[Endorsement on cover:] File No. 44081. U. S. Circuit Court of Appeals, Fourth Circuit. Term No. 674. The United States of America, Petitioner vs. Appalachian Electric Power Company. Petition for a writ of certiorari and exhibit thereto. Filed January 26, 1940. Term No. 674 O. T. 1939.

[33] It is understood that the page numbers herein referred to are those inserted (by stamp) by the Clerk of the United States District Court for the Western District of Virginia rather than those numbers which appeared on the pages of said typewritten transcript of the record when it was filed in said District Court.

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